Electrical World

JULY 3, 1944

EXACT CONTROLS FEATURE ALL-ELECTRIC TIN PLATE MILL

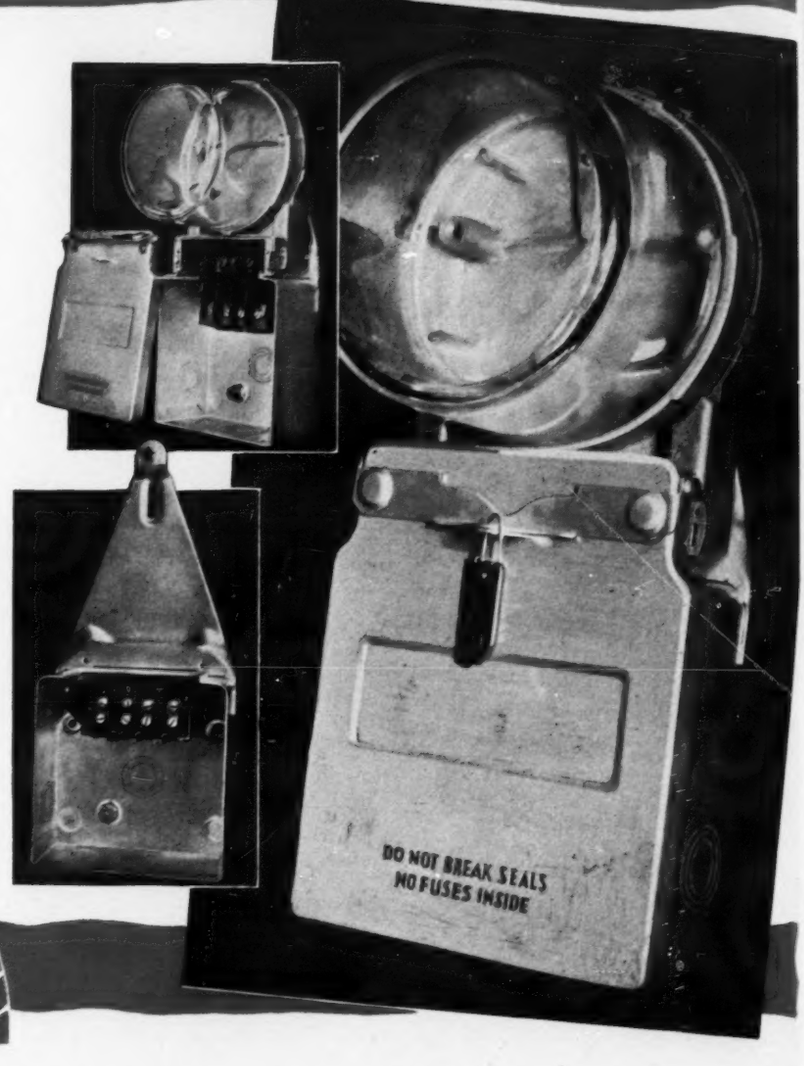
Sturdy reliable new—

THE Murray

"A" Box—modernized

THIS "A" Box is modern—and for indoor and outdoor use. It is rugged and emphatically time-resistant. It accommodates modern, bottom-connected, watt-hour meters. Because of an ingenious arrangement, inherent in the tough case, only one seal is needed. The Murray "A" Box (catalog is number 9600) is generously supplied with knockouts. It occupies standard wall space and has standard mounting holes.

We believe this "A" Box will prove as popular with you as with its many, many users. Metropolitan Device Corporation, Brooklyn 16, N. Y.



MAIL NOW

Metropolitan
Device Corporation
1250 Atlantic Avenue
Brooklyn 16, New York

Send me informative printed matter on unique Murray "A" Box —no obligation

Name_____

Company_____

Address_____

July 8, 1944

Contents

Vol. 122, No. 2

Broadened Program at A.I.E.E. St. Louis Sessions 80
Electronic power, industrial and marine distribution systems and heating houses electrically join cable movement explorations and generation problems in diversifying extensive program.

Network Feeders Use Compensated Regulators 72
R. A. BROWN and F. W. MARQUETTE, Columbus & Southern Ohio Electric Co.

Power Supply for All-Electric Tin Plate Production 74
C. J. DUBY, Republic Steel Co.

Convert Three-Wire Meters on Miniature Assembly Line 78
E. L. HOEFLER, Detroit Edison Co.

Editorials ..... 71 and 88

Washington Comment 90

News of the Week 91

How 99

Load Servicing 120

New Equipment 128

News About People 135

Manufacturing and Markets 146

Sales Opportunities 152

Rural Allotments 154

Recent Rate Action 156

Letters to the Editor 159

Index of Advertisements 162

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From .....

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To .....

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Signed .....

WHY OKOLITE INSULATED CABLES ARE RECOMMENDED FOR INDUSTRIAL CIRCUITS

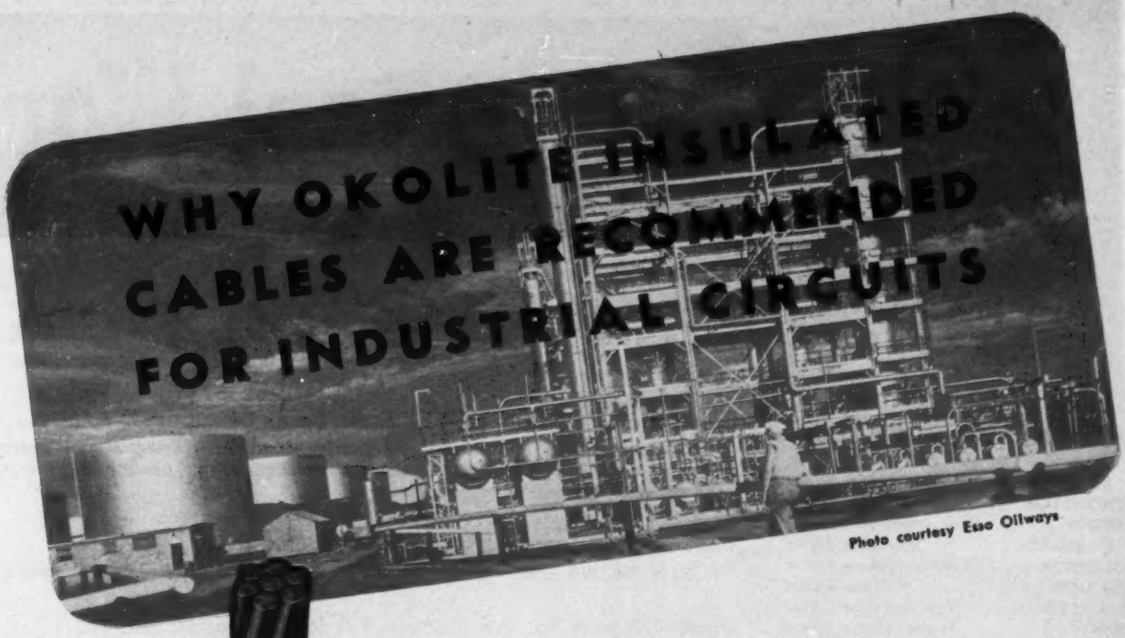


Photo courtesy Esso Oilways

Corrosion resistant Okoloy-coated copper conductor.

Okolite heat and moisture resistant insulation.

Cable tape.

Outer covering (Saturated braid or Thiokol or Okoprene oil-resistant sheath.)

The outstanding electrical and physical qualities of Okolite insulated cables recommend them for a wide variety of installations where stable electrical and physical properties are required. Millions of feet of Okolite, with oil-resistant Okoprene, Thiokol or other protective coverings are installed in refineries, chemical plants and other exacting locations throughout the world.

Electrical Properties: Okolite's electrical qualities include:

- Stable insulation resistance
- High breakdown voltage
- Low dielectric loss
- Low specific inductive capacity

The dielectric constant of Okolite is guaranteed not to increase over 5% after 14 days immersion in water nor will it exceed a 2% change between the 7th and 14th day of such immersion. This high resistance to moisture permits Okolite cables to be installed without lead sheaths in wet locations.

Physical Properties: Physical properties of Okolite oil-base insulation include high resistance to heat — Okolite cables can be operated at copper temperatures up to 75°C. Their good aging qualities and long life have been established both by field installations and accelerated aging tests.

Okolite cables are more fully described in Bulletin OK-2007A. They are recommended for high voltage circuits, interior wiring, underground service, portable cables, apparatus and motor leads and many other uses. Write to The Okonite Company, Passaic, New Jersey.

ARMY E NAVY

OKONITE OKONITE **INSULATED WIRES AND CABLES**

3682

GRAYBAR works with you in all three dimensions

POWER FOR WAR PRODUCTION

To help you maintain power-supply without interruption so that you may always be ready to meet unexpected peak demands caused by war production emergencies, GRAYBAR is ready to rush you essential maintenance supplies.

PREPAREDNESS FOR CHANGE

Industrial conversion is already calling for changes in power supply as new types of production change electrical demands. In this phase of your job, GRAYBAR is ready to work with you, either on new construction or modernization when the "go ahead" signal comes.

PLANNING FOR THE FUTURE

Overloaded systems must be relieved. Outmoded lines must be replaced. New localities must be served, and service extended to more rural areas. For your future planning, remember GRAYBAR as your dependable source of supply for the tools and equipment needed to carry out your post-war program.

of Today's Power Supply Job

THERE IS A GRAYBAR MAN in your area, ready to make your power distribution problems his personal responsibility. Why not take advantage of this time-saving assistance?

GraybaR

IN OVER 80 PRINCIPAL CITIES

Executive Offices: Graybar Building, New York 17, N. Y.

Heap big motors!

When you have a motor 17 feet in outside diameter, you've got something really big. These huge babies are built to drive tankers for the Maritime Commission. Here are the data: a 6600 hp, 93 rpm, 4000 volts, 3 phase, unity power factor synchronous motor—total weight of motor and shaft, over 58 tons.

Size isn't everything, but—a shop that can build motors like these, can do a real job on any motor.

●

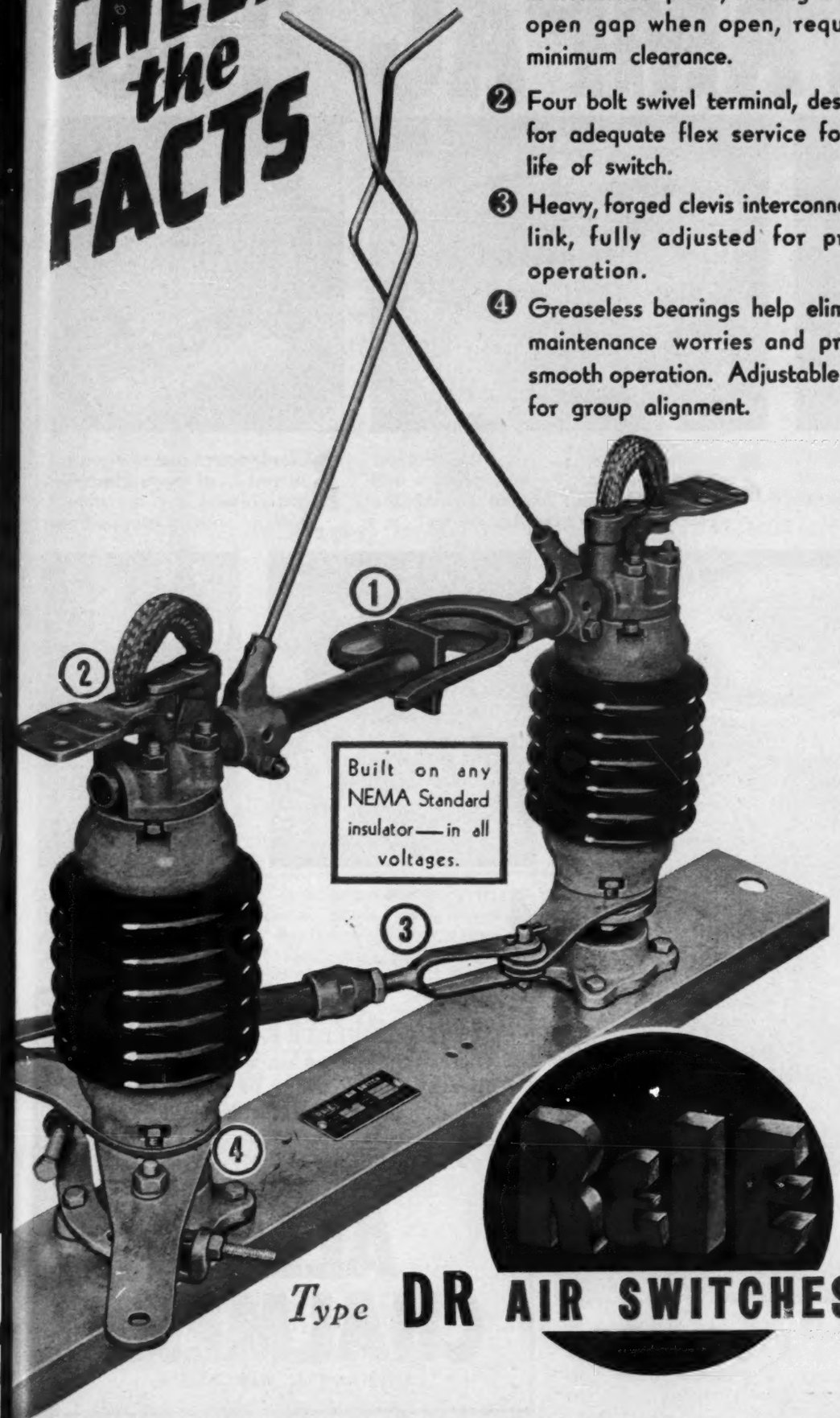
STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

ELLIOTT Compa

Electric Power
RIDGWAY,
DISTRICT OFFIC
PRINCIPAL C

CHECK the FACTS

1. Hi-Pressure, self-cleaning contacts—make and break at center position between insulators. Blades rotate in horizontal plane, making a clear, open gap when open, requiring minimum clearance.
2. Four bolt swivel terminal, designed for adequate flex service for the life of switch.
3. Heavy, forged clevis interconnecting link, fully adjusted for proper operation.
4. Greaseless bearings help eliminate maintenance worries and provide smooth operation. Adjustable stops for group alignment.



Built on any NEMA Standard insulator—in all voltages.

RAILWAY

Type **DR AIR SWITCHES**

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENS
IN CANADA—EASTERN POWER DEVICES, LIMITED,

The Complete Line

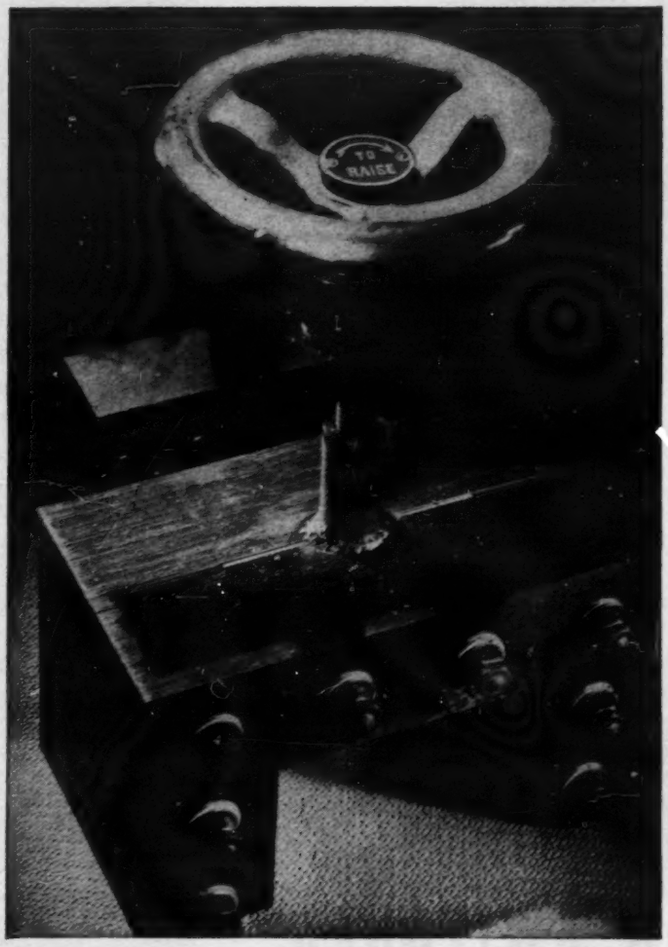
- CONDUCTOR SUPPORT CLAMPS AND FITTIN
- DISCONNECTING SWITCH INDOOR AND OUTDOOR
- AIR BREAK SWITCH
- INTERRUPTER SWITCH
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATIN MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSE
- KIRK INTERLOCI SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLE
- TESTING DEVICE

GET FINER AND FASTER A. C. WELDING WITH AMPAC "400"

1 Revolutionary new patented circuit *increases* efficiency — *cuts* idling loss! Entire construction is *simple, rugged!*

2 Transformer coil uses *rectangular* copper — glass-insulated — with primary over secondary. Air duct between windings dissipates heat — *prevents* breakdown!

3 Sturdy lower core is 1-piece, U-shaped . . . of die-punched silicon steel. Insures quiet operation . . . with *no* power-wasting air gaps!



6 Power regulation is *smooth — quick — simple!* One-inch movement of upper core covers entire welding range — 50 to 500 amps — in *seven turns* of control wheel. Cuts adjustment time to *minimum.* Speeds welding! A 1677

4 Here's typical Ampac quality — a big, tough, *extra heavy* welding terminal. Note *brazed* connections!

5 Hardened brass guide is simple, fool-proof! Channel shape provides *extra* strength.

GET COMPLETE FACTS on this brilliantly engineered a.c. welder from your nearby Ampac dealer or Allis-Chalmers district office. Ask for bulletin B6302. For data on new Ampac "200" welder, ask for bulletin B6241.

ALLIS-CHALMERS

MILWAUKEE, WISCONSIN

CRYSTAL VALVES

High-Efficiency prevents High-stress across insulation

Because...

★ IN DISCHARGING [illegible] AMPERES IT LIMITS THE VOLTAGE TO 43% OR LESS (SEE TABLE BELOW) OF THE CHOPPED WAVE TRANSFORMER TEST VOLTAGE

★ THIS IMPULSE VOLTAGE IS 50% OR LESS (SEE TABLE [illegible] OF THE FULL WAVE TRANSFORMER TEST VOLTAGE

★ THIS IMPULSE VOLTAGE IS [illegible] LESS (SEE TABLE BELOW) THAN THE 60 CYCLE ONE MINUTE INSULATION TEST VOLTAGE

★ THE HIGH-EFFICIENCY BUILT INTO THE

CRYSTAL VALVE

IS THE RESULT OF STRICT ATTENTION PAID THE MINUTEST DETAILS BY CONSTANT RESEARCH IN THE LABORATORY AND BY ACTUAL OPERATING EXPERIENCE

IMPULSE VOLTAGE LEVELS

TRANSFORMER TEST			PERMITTED BY CRYSTAL VALVE	
GRAPH	2400 VOLTS		GRAPH	3000 VOLT RATING
A1	Chopped Wave	69 KV	A2	19 KV-IR Drop 20000 Amperes 10x20 Wave
	Full Wave	60 KV		14 KV-Impulse Breakdown
	60 Cycle Crest—1-Minute	27 KV		11 KV-IR Drop 1500 Amperes 10x20 Wave
	7200 VOLTS			9000 VOLT RATING
B1	Chopped Wave	110 KV	B2	47 KV-IR Drop 20000 Amperes 10x20 Wave
	Full Wave	95 KV		43 KV-Impulse Breakdown
	60 Cycle Crest—1-Minute	48 KV		31 KV-IR Drop 1500 Amperes 10x20 Wave

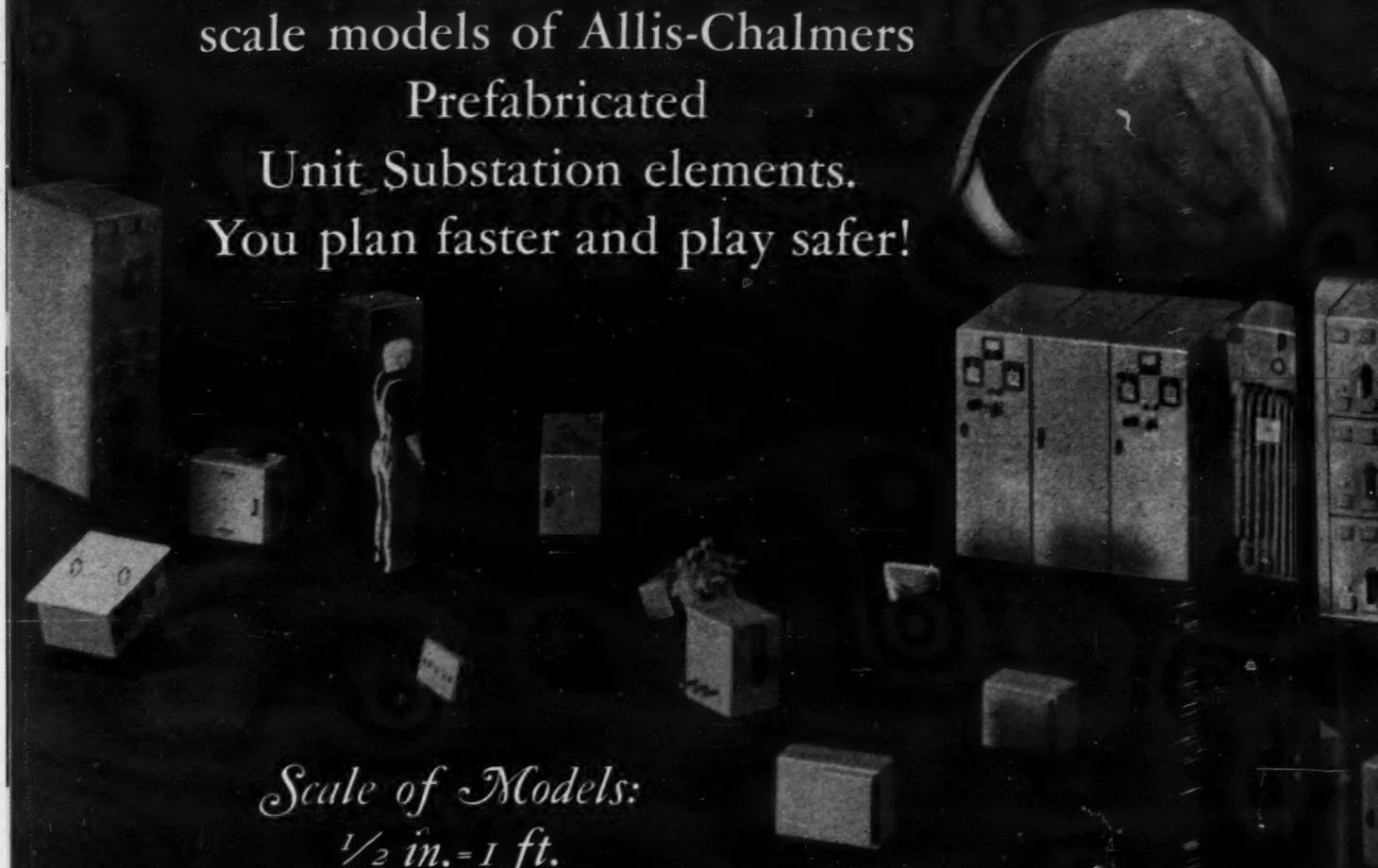
WRITE FOR TECHNICAL LITERATURE · ELECTRIC SERVICE MANUFACTURING CO. · PHILADELPHIA 32 · PA

CRYSTAL VALVE

LIGHTNING ARRESTERS

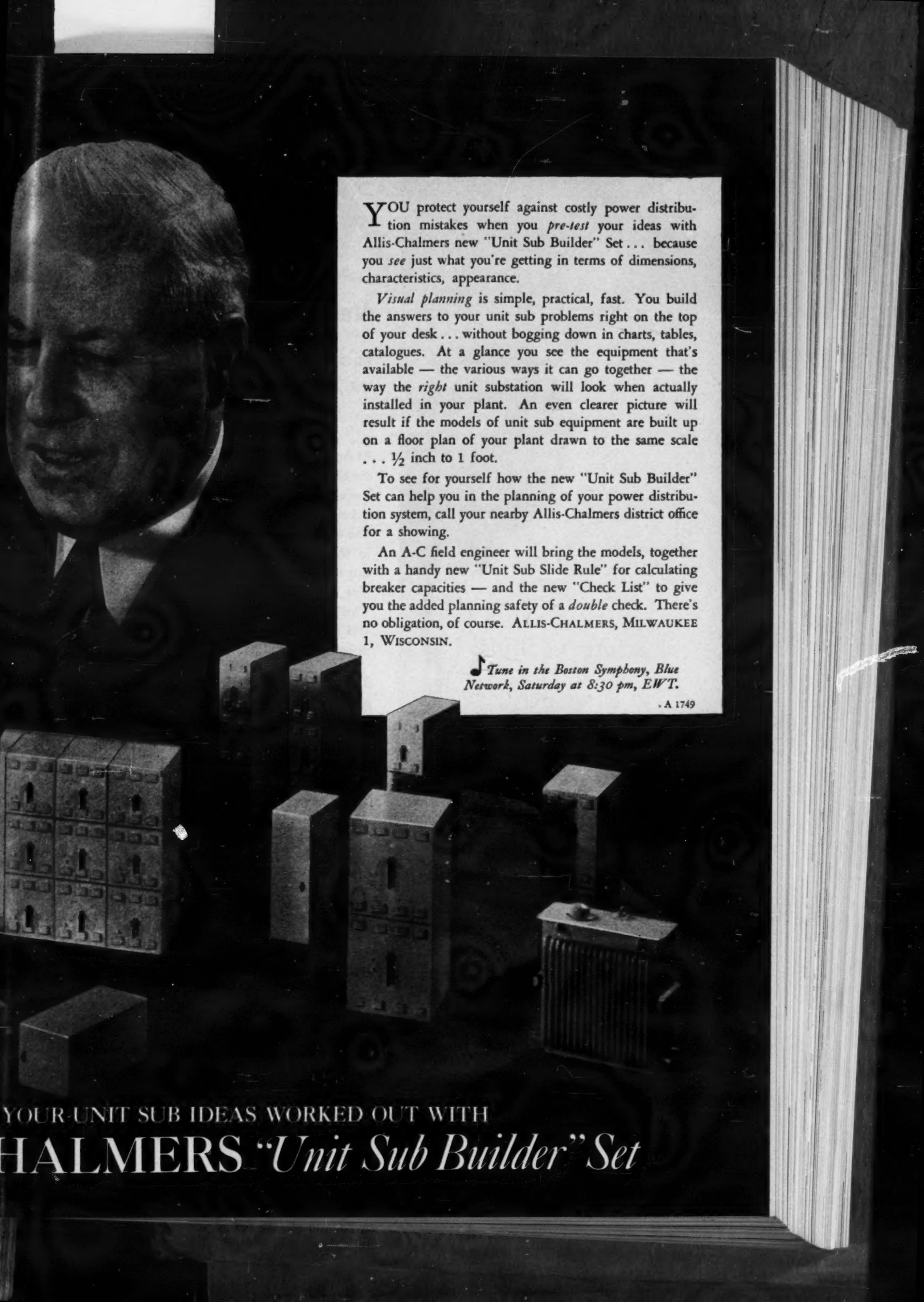
Say Goodbye to "BY-GUESS and BY-MEMORY"

That's what you do
when you plan unit substations
visually — with new
scale models of Allis-Chalmers
Prefabricated
Unit Substation elements.
You plan faster and play safer!



Scale of Models:
½ in. = 1 ft.

ALLI H



YOU protect yourself against costly power distribution mistakes when you *pre-test* your ideas with Allis-Chalmers new "Unit Sub Builder" Set . . . because you *see* just what you're getting in terms of dimensions, characteristics, appearance.

Visual planning is simple, practical, fast. You build the answers to your unit sub problems right on the top of your desk . . . without bogging down in charts, tables, catalogues. At a glance you see the equipment that's available — the various ways it can go together — the way the *right* unit substation will look when actually installed in your plant. An even clearer picture will result if the models of unit sub equipment are built up on a floor plan of your plant drawn to the same scale . . . ½ inch to 1 foot.

To see for yourself how the new "Unit Sub Builder" Set can help you in the planning of your power distribution system, call your nearby Allis-Chalmers district office for a showing.

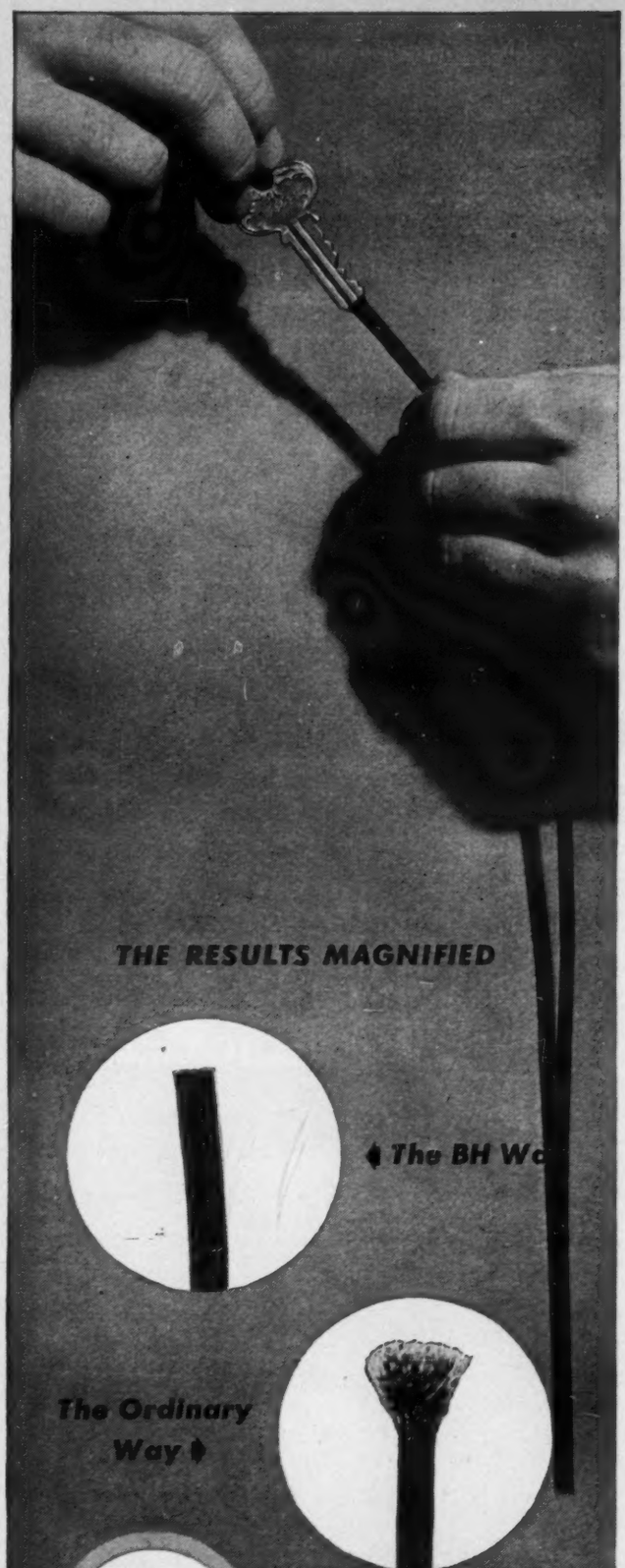
An A-C field engineer will bring the models, together with a handy new "Unit Sub Slide Rule" for calculating breaker capacities — and the new "Check List" to give you the added planning safety of a *double* check. There's no obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*

A 1749

YOUR UNIT SUB IDEAS WORKED OUT WITH

HALMERS *"Unit Sub Builder" Set*



KEY TEST

Opens Up New Sleeving Advantages

PROVE TO YOURSELF THE NON-FRAYING, FLEXIBLE QUALITIES OF BH *EXTRA FLEX* FIBERGLAS SLEEVING

MAKE THIS simple test right at your desk and you'll see that here at last is a truly non-fraying, flexible sleeving. Just take a length of BH *Extra Flexible* Fiberglas Sleeving and jam an ordinary key into one end. Turn it around and push it up and down in the sleeving. Notice how the sleeving spreads but doesn't fray. Now do the same with a similar size piece of your present saturated sleeving. It breaks and frays. Further abuse unravels it. But BH Sleeving stands up under rough handling and severe service alike.

BH EXTRA FLEXIBLE FIBERGLAS SLEEVING

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT • NON-INFLAMMABLE • WATER-RESISTANT • VERMIN-PROOF NON-DETERIORATING • HIGH DIELECTRIC AND YARN STRENGTH • NON-CRYSTALLIZING at LOW TEMPERATURES

BH Sleeving is woven from choicest continuous-filament Fiberglas yarns and treated by an exclusive BH process that gives it stamina and pliability. Natural properties of Fiberglas as an insulator are virtually unequalled. So why be content with any less efficient sleeving? You'll want to try the BH test yourself. BH Sleeving is available in all sizes from No. 20 to 5/8", inclusive. Write for samples of specific sizes *today* and be convinced. Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

100H UNIVERSAL MATTHEWS FUSE LINKS

COVERED BY PATENTS 1,797,850, 2,067,577 AND PATENTS PENDING

BEST FOR CASCADING

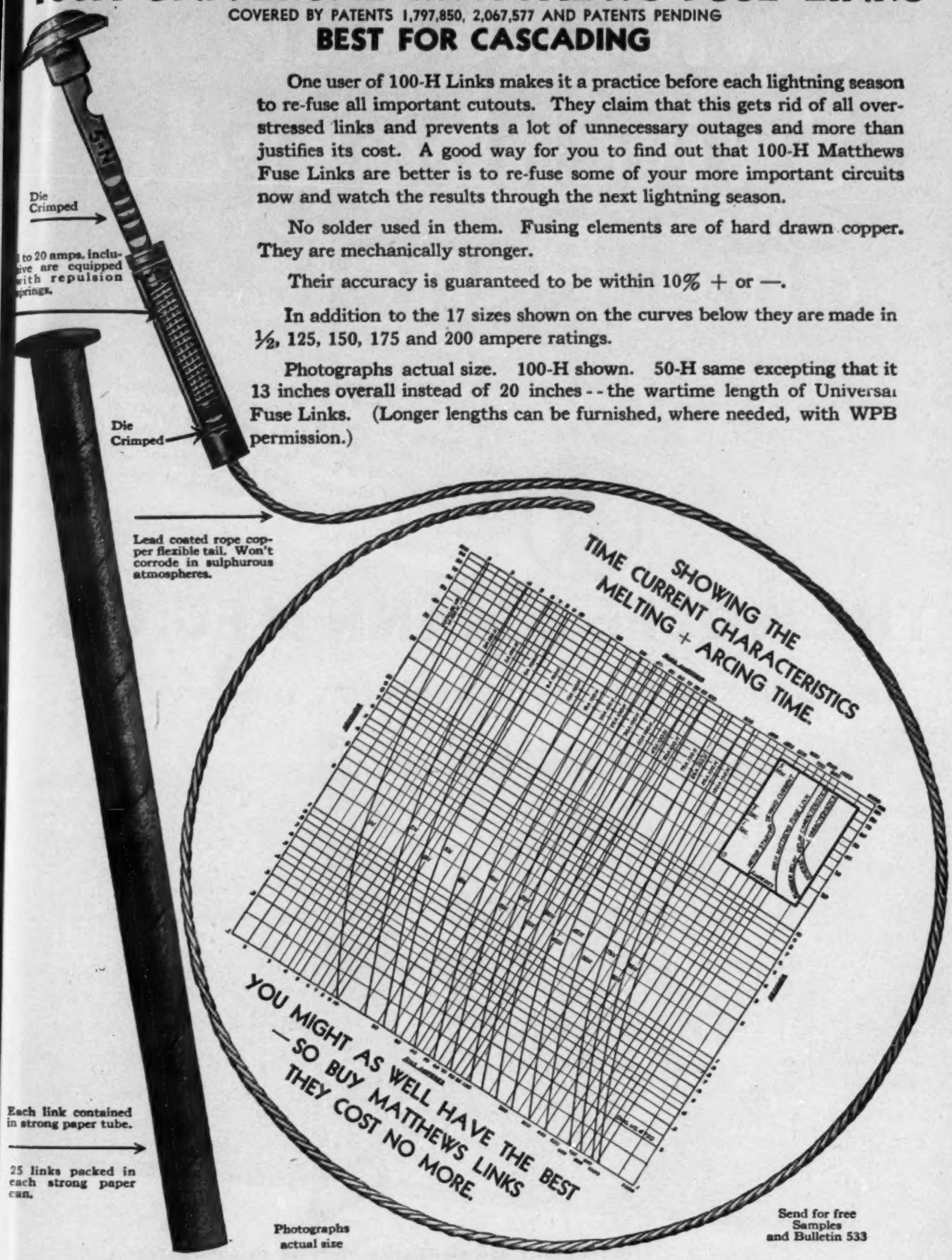
One user of 100-H Links makes it a practice before each lightning season to re-fuse all important cutouts. They claim that this gets rid of all over-stressed links and prevents a lot of unnecessary outages and more than justifies its cost. A good way for you to find out that 100-H Matthews Fuse Links are better is to re-fuse some of your more important circuits now and watch the results through the next lightning season.

No solder used in them. Fusing elements are of hard drawn copper. They are mechanically stronger.

Their accuracy is guaranteed to be within 10% + or —.

In addition to the 17 sizes shown on the curves below they are made in ½, 125, 150, 175 and 200 ampere ratings.

Photographs actual size. 100-H shown. 50-H same excepting that it 13 inches overall instead of 20 inches--the wartime length of Universal Fuse Links. (Longer lengths can be furnished, where needed, with WPB permission.)


Die Crimped
1 to 20 amps. inclusive are equipped with repulsion springs.
Die Crimped
Lead coated rope copper flexible tail. Won't corrode in sulphurous atmospheres.
Each link contained in strong paper tube.
25 links packed in each strong paper can.
SHOWING THE TIME CURRENT CHARACTERISTICS MELTING + ARCING TIME.
YOU MIGHT AS WELL HAVE THE BEST —SO BUY MATTHEWS LINKS THEY COST NO MORE.
Photographs actual size
Send for free Samples and Bulletin 533

W. N. MATTHEWS CORPORATION, ST. LOUIS, U. S. A.

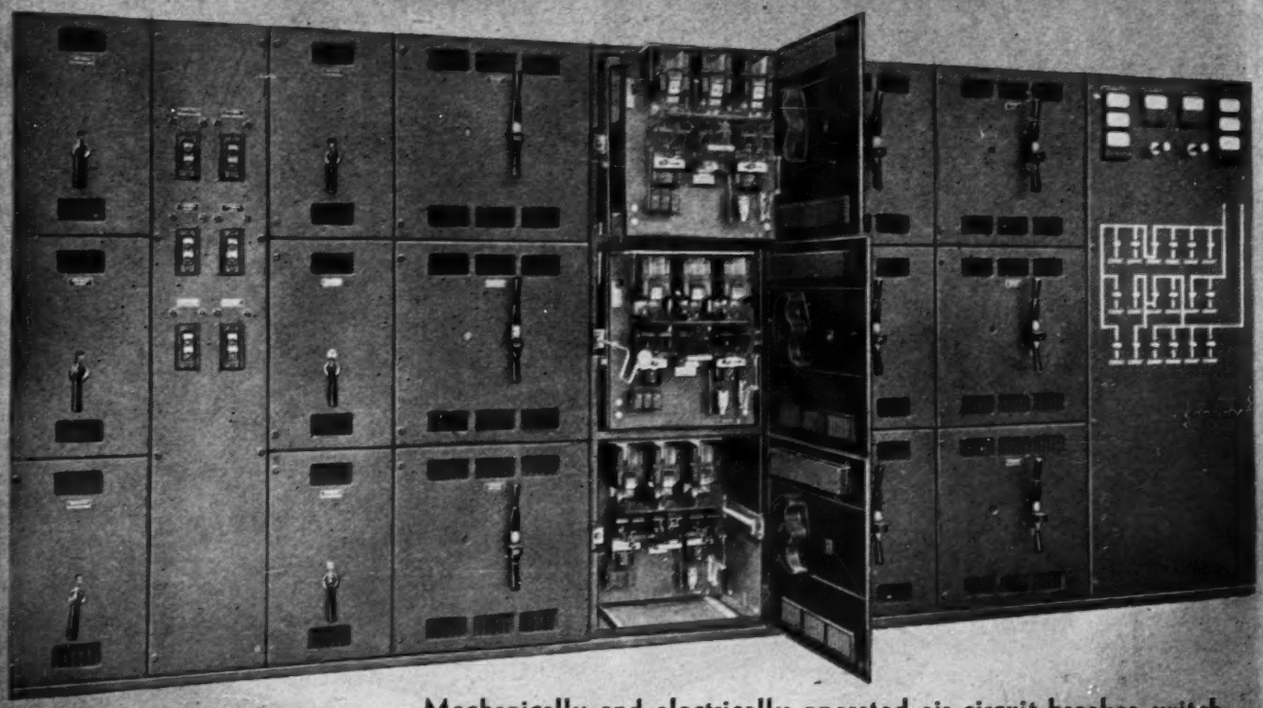
Switchgear Switchboards and Panels

by

For 22 years central stations, large industrials, government departments and educational institutions have found Switchgear, Switchboards and Panels by Wolfe & Mann highly satisfactory in purchase price, performance and low maintenance cost. Wolfe & Mann manufacture the most advanced types of electrical switching equipment, including cubicle, metal-clad and drawout types for both indoor and outdoor use. Write today for catalog or send us an invitation to bid.

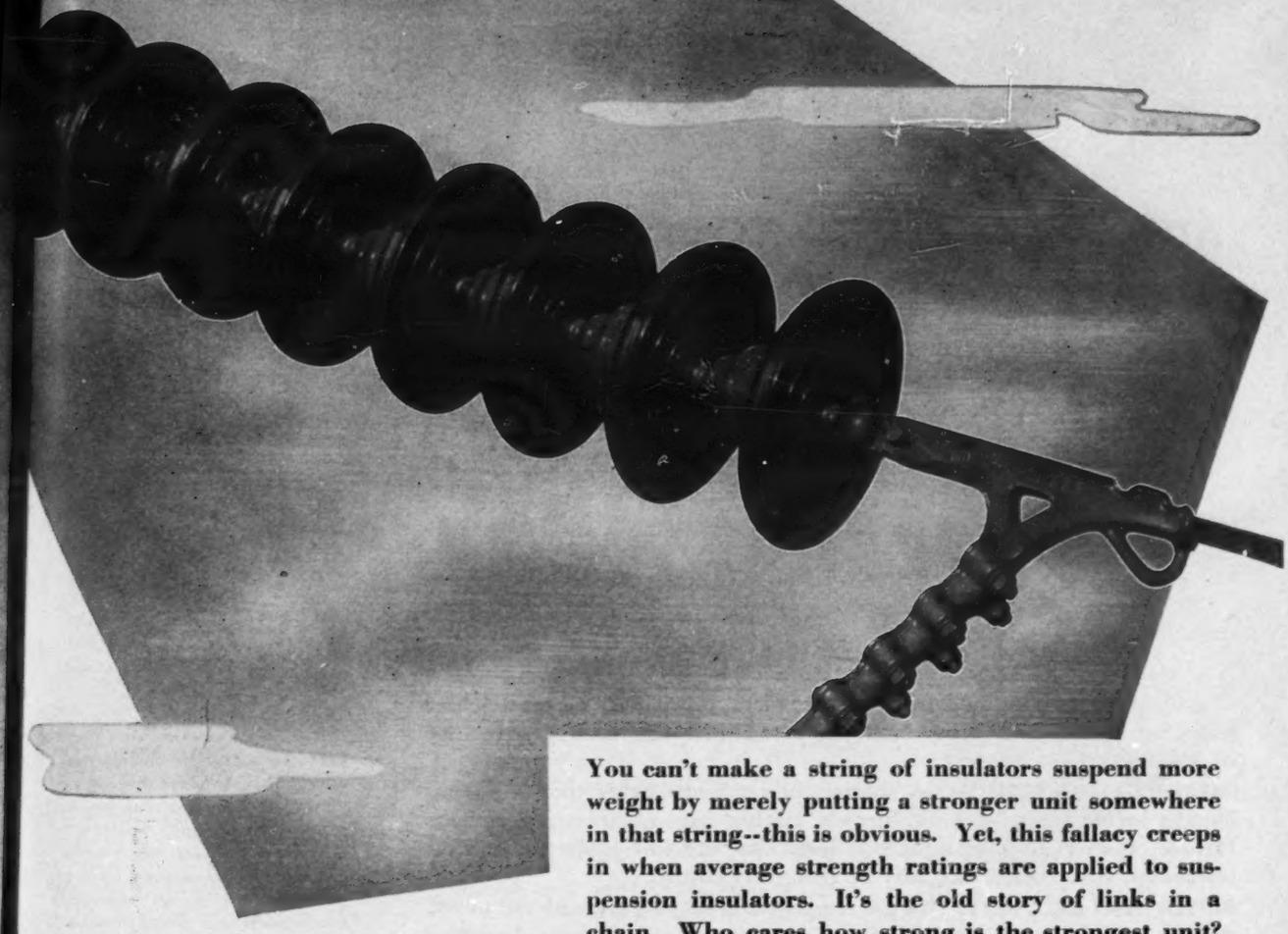
THE WOLFE & MANN MFG. CO.

28th & SISSON STREETS, BALTIMORE 11, MARYLAND



Mechanically and electrically operated air circuit breaker switchboard, withdrawable type, for wind-testing tunnel laboratory.

You can be sure of strength when you use O-B suspension insulators



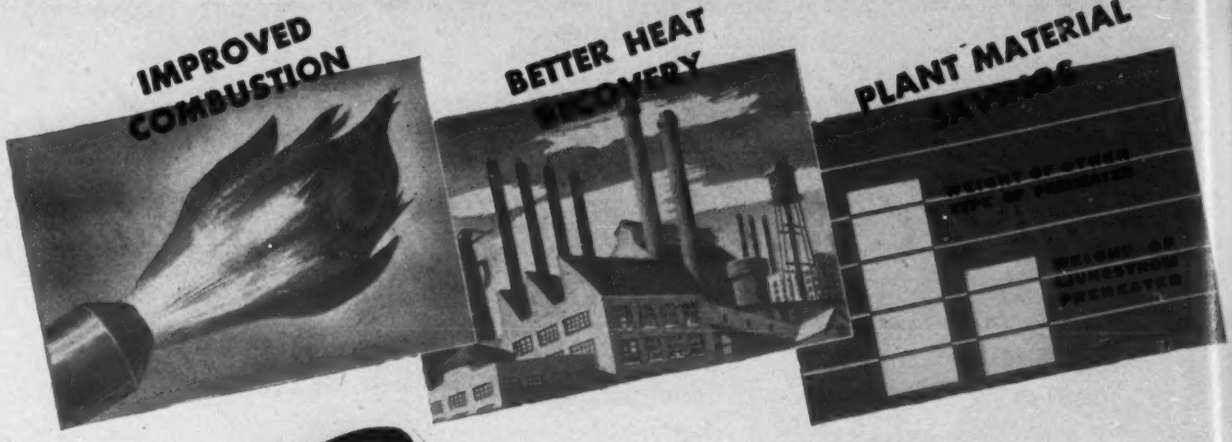
You can't make a string of insulators suspend more weight by merely putting a stronger unit somewhere in that string--this is obvious. Yet, this fallacy creeps in when average strength ratings are applied to suspension insulators. It's the old story of links in a chain. Who cares how strong is the strongest unit? What we *really* want to know is how weak is the weakest...And you *can know* this when you specify O-B. These suspension insulator units are individually rated with specific minimum strength values. Most units will exceed this rating, but this is merely incidental. What you really know is that none will fall below this value. The strength rating, permanently marked on each cap, is the safe working load of an entire string made up of any number...It has taken years to perfect designs and manufacturing technique to make possible O-B's minimum strength rating but, with it, you now get the kind of strength that *counts*, because you can *count* on it!

2481-H

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED.
NIAGARA FALLS, ONTARIO



ADD *ALL 3* TO YOUR MODERNIZATION PLANS

THROUGH

PREHEAT *Engineering*

If you are planning to modernize a boiler plant, oil refinery heater or other industrial furnace, don't overlook the possibilities for more effective use of preheated air.

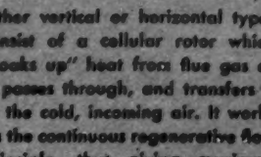
IMPROVED COMBUSTION. A shorter, hotter flame helps complete combustion before gases leave the furnace. Higher rates of liberation increase furnace capacity. High-moisture powdered coal and low grade fuel such as screenings, coke breeze, etc., may be effectively burned.

BETTER HEAT RECOVERY. Flue gas temperatures may be reduced 200 to 500 degrees, and the heat returned with minimum loss to the incoming combustion air. Thermal efficiency of the furnace may be increased up to 10% or more.

SAVINGS IN PLANT MATERIALS. The Ljungstrom Preheater is unusually compact, effecting savings in weight of both heating surface and supporting structure. In many cases, the Ljungstrom weighs less than half as much as other heat recovery installations with the same capacity.

ENGINEERING SERVICE. The engineering staff of the Air Preheater Corporation is prepared to assist you in applying either the standard or special types of Ljungstrom Preheaters to your present plant, or to assist you in engineering it as an integral part of new units.

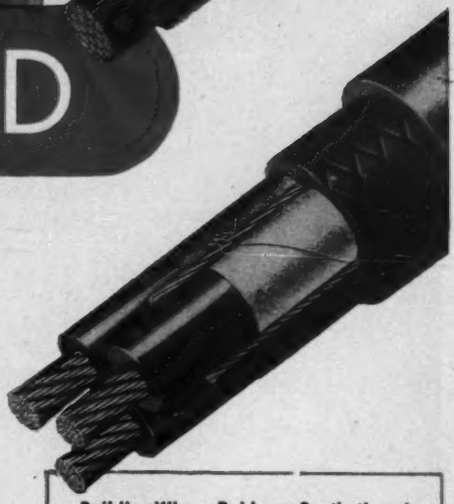
THE LJUNGSTROM AIR PREHEATER. Either vertical or horizontal types consist of a cellular rotor which "soaks up" heat from flue gas as it passes through, and transfers it to the cold, incoming air. It works on the continuous regenerative flow principle, thus giving maximum heat transfer with minimum weight and size.



THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd Street • New York 17, N. Y. • Plant: Wellesville, N. Y.

HONOR GRADUATES OF THE SCHOOL OF *hard knocks!*



AMERCLAD

will give you long, dependable service under tough working conditions

IN this kind of service — where portable power cables are subjected to every kind of abuse—dragged over rough and rocky ground, hauled through water, grease and mud, stepped on, run over and heartlessly exposed to every change of weather, AMERCLAD really shows how much stamina and endurance can be built into a cable.

Designed and constructed to deliver an uninterrupted flow of power, AMERCLAD Portable Power Cables meet every requirement of the wartime speed up.

AMERCLAD Low Voltage Cables are flexible to permit continual reeling and unreeling, yet are sufficiently tough and rugged to withstand severe usage of all kinds. They are designed to operate satisfactorily under heavy overloads and attendant high temperatures. Their resistance to water, oil and acids is a further aid to long service.

AMERCLAD High Voltage Cables provide high impulse strength plus flexibility without danger of corona cutting so that when operated with suitable line protection they insure continuity of service and freedom from breakdown.

Even now, when crude rubber is not available and the use of Neoprene is greatly restricted, we have developed synthetic rubber compounds for use in Amerclad Cables that carry on the old tradition of trouble-free service. To save time and money, use AMERCLAD.

Building Wire — Rubber or Synthetic resin insulation.
Non-Metallic Sheathed Cable
Service Entrance and Drop Cable
Power Cables — Rubber, Varnished Cambric or Paper Insulation
Armored Submarine or Parkway Cables
Non-Metallic Parkway Cables
Rubber-sheathed Cords and Cables
Heat-proof Asbestos Insulated Cables
Weatherproof and Annunciator Wire
Magnet Wire of all types and sizes
Galvanized Steel Wire and Strand
Rural Distribution Conductors.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS

UNITED STATES STEEL

How it was done with
CENTRAL RIGID STEEL CONDUIT
"There's
Tested Strength
in Every Length"
CENLACO (HOT DIPPED)
CENTRAL BLACK
SPANG-CHALFANT
Division of The National Supply Company
Executive Offices: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

FREE ENTERPRISE

The Obligation of Management and Labor to Cooperate... in War... in Peace

The Invasion is on! We have unleashed our full might r military victory. We have confidence that our great rength will bring success. We are strong because we ve achieved unity in mobilization and in combat.

Though victory appears assured, we cannot rest until e have done everything in our power to speed the day hen death and destruction are halted.

The home front is an important factor in this time ement, for the fighting power of our Armed Forces epends upon their weapons. Napoleon's army fought n its stomach"—man against man. Eisenhower's men ght on their tonnage—tanks, artillery, machine guns, avy bombers.

As never before in the long succession of wars, the gends of heroic deeds on the battlefronts in this world nflict will be paralleled in history by the great accomishments on the production fronts. Along with these roic achievements of our Armed Forces, the world will ng remember the record of our production accomplishents which have made us the stongest military power the world, as well as the arsenal of democracy.

As the conflict reaches its climax, as battles grow ercer and more destructive, our responsibility becomes reater and more critical. We must coordinate our productive efforts with the same ingenuity and the same recision with which our Armed Forces have coordiated theirs. We dare not waste the productivity of a ingle man or machine in these critical days.

As our landing craft are discharging our fighting men n the beaches of Europe and the Pacific, they must not ant for equipment. No interference with war production for any reason can be justified. There must be no icket lines in America!

The landing of American troops in France virtually as stopped all strikes in the United States. This is important and encouraging news because the prelude to nvasion, unfortunately, has been an epidemic of strikes. Time lost through strikes, during the first four months f 1944, was double that lost during the same period st year. April saw more strikes than any other month nce Pearl Harbor, and in May the record again was roken. Here is what happened within two weeks in May:

Nine thousand men in six Chrysler plants in Detroit were out when a jurisdictional dispute in a "soda pop" war between the American Federation of Labor teamsters and the Congress of Industrial Organizations fired their discontent.

A three-day sit-down strike occurred among 950 employees in the B. H. Aircraft plant over the refusal of the company to discharge a superintendent unsatisfactory to the union.

Thirteen hundred men in the Chevrolet transmission and axle plant at Saginaw struck over a no-smoking rule and a change in shift-starting time.

Two thousand employees at the Browne and Sharpe Manufacturing Company walked out when a woman was hired to fill a job long held by a man.

Production of penicillin, blood plasma, and other medical supplies was halted at two Detroit plants of the Parke Davis Company as 1900 employees struck for a ten-cent raise.

Over 25,000 lumber workers in the Pacific Northwest struck because the War Labor Board denied their demand for a wage increase.

At the end of the third week of May, 70,000 workers in 26 plants in Detroit were idle because of strikes.

Strikes in Detroit alone reduced production as much as a moderately successful German air raid would have done. Far more important than their effect on output is the effect of strikes upon national unity and morale. To our home front and to our Armed Forces, strikes belie our pledge to back the attack with all the power at our command. Hence, strikes limit our all-out war effort.

Prompt and decisive action is needed to keep America free from strikes for the remainder of the war. Stoppages of work on the production lines cannot be condoned while lives are being lost in fighting the enemy.

Most union leaders realize this need and are preparing to impose discipline upon their members who violate the no-strike pledge. The Warehouse Division of the International Longshoremen's and Warehousemen's Union (C.I.O.) recently declared: "Strikes in this time of war are treason against the nation and betrayal of the interests of labor." A message sent by William Green to all heads of American Federation of Labor unions stated:

"D-day is here. From now on until Hitler is finally crushed, every worker enrolled in the army of production must consider himself a part of the invasion forces of the United States and conduct himself accordingly. I call on you in the name of the American boys who are risking their lives under enemy fire to maintain uninterrupted production under any and all circumstances. Until victory is won every worker must give the same all-out service that our Armed Forces are giving on the field of battle."

Strongest of all was the appeal of R. J. Thomas, president of the United Automobile Workers, to members of his union:

> "Our union cannot survive if the nation and our soldiers believe that we are obstructing the war effort . . . there can be no such thing as legitimate picket lines . . . I appeal to our membership. If you value your union, if you want to live and serve after the war, we must restrain ourselves and our hot-headed brothers today. If we do not, there will be no union after the war."

Union officers are entitled to vigorous support from management and government in their efforts to prevent strikes. Behind many a strike is an accumulation of unsettled grievances. Managements are overworked, and many union shop stewards are new and inexperienced and do not always do their part in turning down cases which lack merit. Both of these conditions make it easy for large backlogs of unsettled grievances to pile up. A special drive to clean up unsettled cases and to prevent new accumulations of them is one way by which managements and local union officials can help shorten the war.

The government too has a contribution to make to the prevention of strikes—both through the prompt disposal of disputes and through firm action against the leaders of strikes. The National War Labor Board and the Regional Boards are disposing of over five thousand cases a month and have made an excellent record in reducing their backlogs. Nevertheless, the boards still have many old cases; and about one out of four strikes has been an effort to get action from one of the labor boards. The boards are entitled to cooperation from employers and unions in keeping down their docket. In instance after instance, cases are dumped in the lap of the board before the union and employer have made a real effort to get a meeting of minds and to work out settlements.

In the present emergency, strikes are an expression of the lack of adequate understanding and team work between unions and management. Any future great upsurge in industrial strife likewise will be due to misunderstanding. After this war this country must not go through another "1919" when the time lost from strikes reached an all-time high. With 13 million workers, or almost half of the non-salaried employees of the country, in trade unions, the power and prestige of unions is greater than ever. ***The long-run prosperity of the country requires that business and labor learn how to cooperate in supporting the policies which produce the largest possible profits and the largest possible payrolls.***

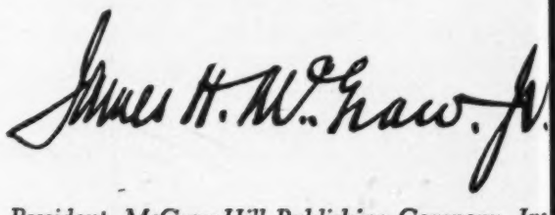
Although business is primarily interested in the largest possible profits, and labor is primarily interested in the largest possible payrolls, both objectives call for the same basic conditions. Payrolls depend upon the prospects for profits. If bad relations between business and labor or unwise public policies cause employers to take a pessimistic view of the outlook for profits, both employment and payrolls will be depressed.

Individual unions and individual employers always will have differences over wages and hours and the status of labor in particular plants or in particular occupation Some disputes on such issues are inevitable, but reso to arbitration and calm intelligence can help greatly avoiding strikes in the long run. Cooperation betwe labor and management is an economic necessity. In o kind of economy, payrolls and profits ***both depe upon the willingness and the ability of business a labor to work together in creating the conditions u der which enterprise flourishes.***

The foundation for intelligent and effective coope tion must be accomplished by skillful and imaginati managers in plants throughout the country who are wi ing to help unions with their problems, and who are ab to interest union leaders and their members in th problems of business. Union members and their leade are keenly interested as a rule in the efforts of manag ment to win new markets. They know that jobs depe upon the success of managements in improving th product, adding new items to the line, and, less frequen ly, cutting costs and prices. Employees like to be ke informed about what management is doing, what pro lems it is meeting, and what success it is having. Mo of all, they like to have an opportunity to contribut their ideas and suggestions.

The recent epidemic of strikes should not blind us t the fact that even today there are more plants wher managements and unions are on good terms than eve before in the country's history. Consider, on the on hand, the extensive and constantly growing efforts o unions to train and develop shop stewards and, on th other hand, the efforts of employers to teach foreme how to carry out the new responsibilities imposed upo them by union agreements. Unions and management together are learning how to operate together such tech nical devices as time study and job evaluation. Manage ments which, several years ago, opposed the provision o umpires to interpret union agreements and to settl deadlocked cases today are taking the lead in suggestin such arrangements.

The war is reaching a crisis, and all groups in th country must be aware as never before of their com mon interests. This presents an opportunity whic should be seized to lay the permanent foundations fo more effective team work in American industry. Let his tory record that the days when Europe was being lib erated also were the days when unions and employer were making unprecedented progress in preparing Amer ican industry for the return of the service men by de veloping policies of cooperation between business and unions. Such cooperation will help achieve a peace worthy of our efforts and our sacrifices.



President, McGraw-Hill Publishing Company, Inc.

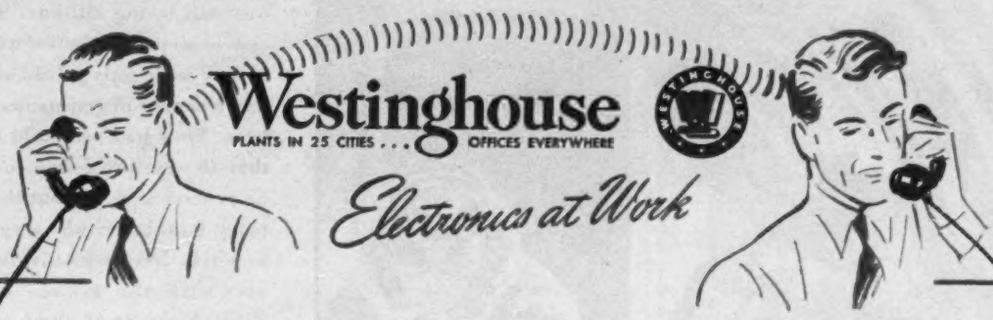
FOR CLOSER SCHEDULING OF POWER FLOW

consider carrier communication!

For interconnected systems serving heavy wartime loads, demands on voice communication facilities are vastly increased. Immediate communication between dispatchers' offices on neighboring lines is a *must*—to permit close scheduling of power flow, and make available maximum generating facilities to meet major variations in load.

At the same time, regular telephone circuits are greatly overloaded. Additional lines cannot be constructed. Therefore, use of carrier channels for voice communication is a most practical solution.

Westinghouse carrier communication equipment is simple to install. It is reliable, low in cost, uses a minimum of critical materials. Your Westinghouse office can give you full information and engineering assistance. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. J-97088



ONLY THESE BASIC ELEMENTS ARE REQUIRED

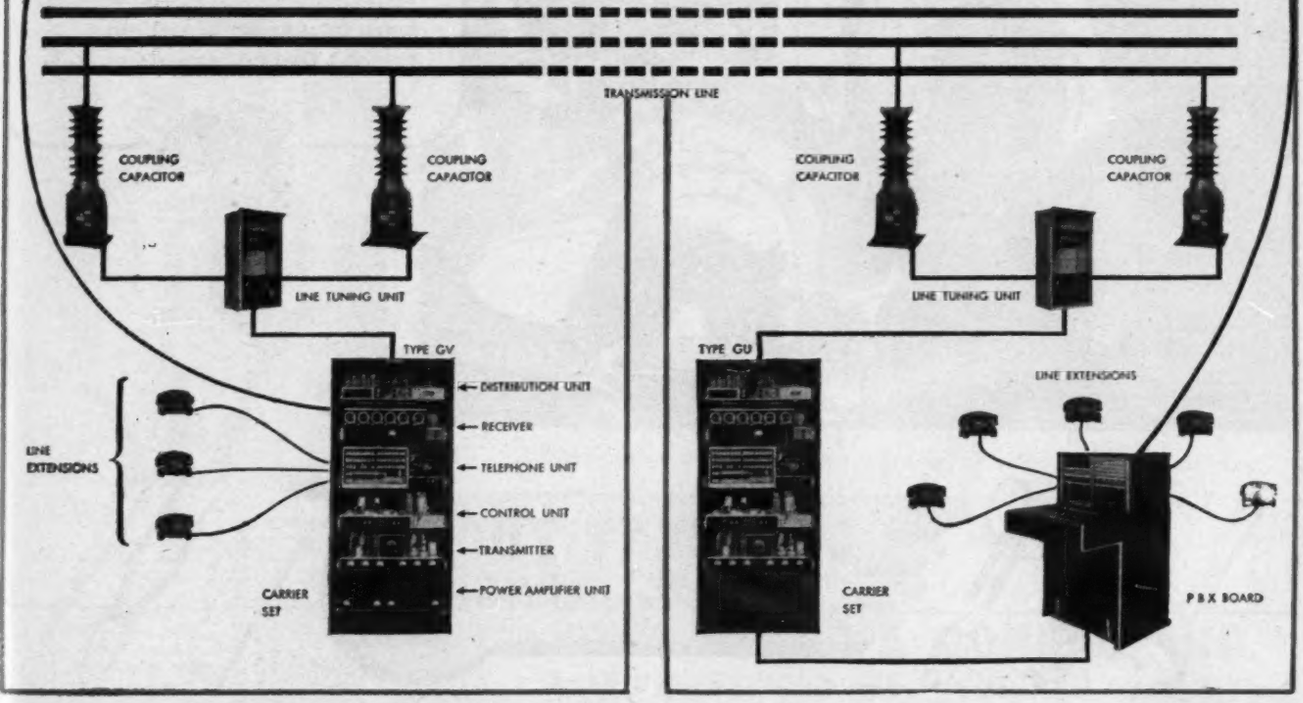
Carrier Set—includes Transmitter, Receiver, Power Supply and Telephone Equipment. Preferred service gives dispatcher use of channel at any time. Others are locked out.

Line Tuning Unit—whose inductive reactance neutralizes the capacitive reactance of the coupling capacitor.

Coupling Capacitors—provide a path through which carrier flows into or out of the line.

Line Extensions—as many as 10 line extensions may be selectively called. One or more extensions may be 10 or 15 miles long. Automatic compensation is provided so short line as well as long line voice levels are the same.

PBX Board—one or more of the 10 extensions from the Carrier Set may be to PBX Boards for further extensions, or to other carrier channels.



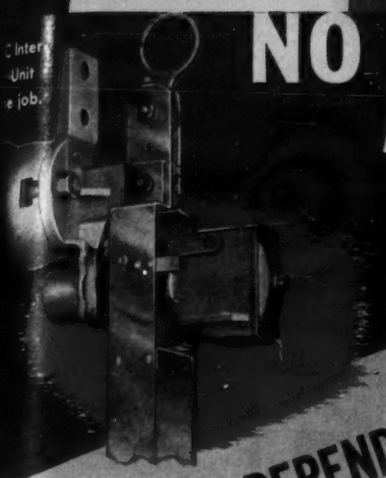
"A CRESCENT WRENCH, A PAIR OF PLIERS AND A LOT OF CUSSING," BUT

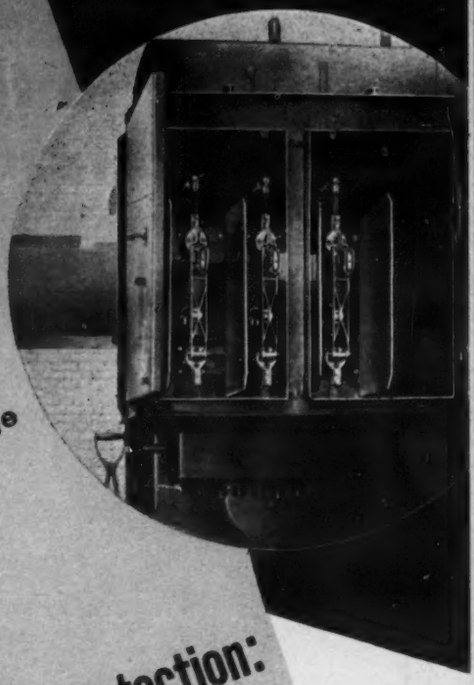
They Lived to Fight Again

● According to the news dispatches, the crew of this unnamed Flying Fortress had already jettisoned every removable piece of equipment . . . guns, flak suits, armor plating and ammunition, but the badly-hit plane was still losing altitude. Then their eyes centered on the 8-ton ball turret. If they could only get rid of that, they had a chance of getting back to home base. They had been told in lectures that it was impossible to remove a ball turret in flight, but they decided to try. Four battle-wise sergeants went to work. Net result: in fifteen minutes with the aid of "a Crescent Wrench, a pair of pliers and a lot of cussing," they were able to drop the turret, and thus lightened, the ship zoomed up and on to England, and safety. That's the story, and that is why there are plenty of Crescent Wrenches over Axis territory, and very few in the hands of Crescent dealers. With Victory, the tables will be reversed. Even now, small though the supply, we are filling as many home front orders as possible.

Crescent Tool Co., Jamestown, N. Y.

NO ARCING
AT MAIN SWITCH CONTACTS



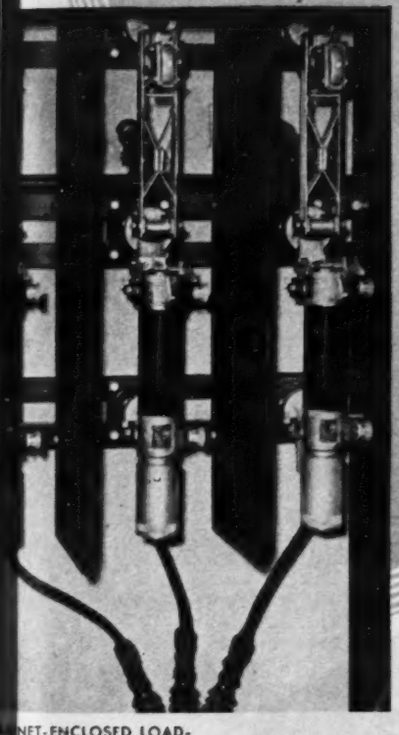


SAFETY, DEPENDABILITY, ECONOMY
For performing these load switching operations:

(a) on substation installations,
(b) for line and feeder sectionalizing,
(c) for interrupting magnetizing current of large transformer banks,
(d) for by-passing and isolating feeder voltage regulators,
(e) for disconnecting capacitor banks.

Add SIMPLIFIED short circuit protection:

(1) At System Feeder Substations
(2) Customers' Services
(3) At System Feeder Tap Locations
(4) For Switching and Bus Protection on Large Industrial Systems
(5) At Power Company Industrial Substations



NET-ENCLOSED LOAD-RUPTER AND FUSE COM-TION, 7500 volt, 400 am-3-pole, gang-operated, ncell housing, and with e control handle. For in-service on power center ol. Operating at 4160 it provides load switching short circuit protection of num 400 ampere current.

AVAILABLE RATINGS:
400 Amp. . . . 15 KV
400 Amp. . . 7.5 KV

S&C Load Interrupter Disconnects and Combination Disconnect-Fuse Assemblies are available for either indoor or outdoor installations. Hundreds of installations during the past three years have proved their reliability and economies. . . . Let us mail Bulletin 202-A.

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4435 RAVENSWOOD AVE. • CHICAGO 40, U.S.A.
Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ont.

How to fight a fire before it starts...

FREE BOOK HELPS KEEP EXTINGUISHERS READY FOR ACTION

You'll be prepared to nip fires quickly at your plant only if your *extinguishers* are ready. And that calls for periodic examination.

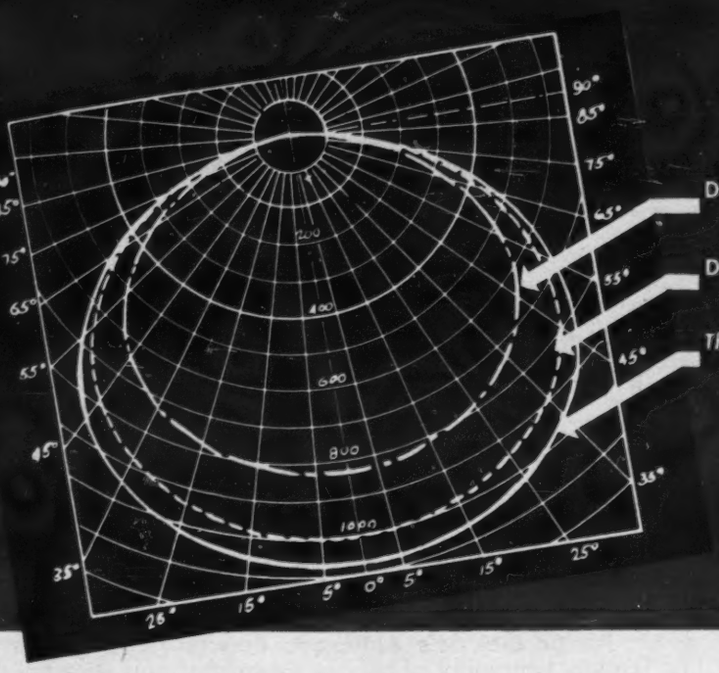
To make it easy for you to set up a maintenance system, Walter Kidde & Company has issued a booklet—"INSPECTION AND MAINTENANCE OF FIRST AID FIRE EXTINGUISHERS." It covers every type of equipment, tells where to locate them, how to mark them for quick identification, what to check, how and when to recharge. It suggests forms for keeping records. Write for your free copy today!

WALTER KIDDE & COMPANY, INC., 140 CEDAR STREET, NEW YORK 6, N. Y.

A LITTLE ATTENTION KEEPS

ALZAK* ALUMINUM REFLECTORS

WORKING AT TOP EFFICIENCY



See what cleaning does for a Reflector:

Dirt had caused a 23% loss in efficiency.

Dry-wiping reclaimed 16% of that loss.

Thorough washing gave it this efficiency.

They're war workers, those Alzak Aluminum Reflectors on the lighting system in your plant, designed and finished to do a most efficient job. Don't handicap them by neglect.

Note in the above light chart what a tremendous difference that dirt, if allowed to collect on a reflector, makes in reflectivity. Quite often, all that Alzak Reflectors need to keep them working at top efficiency is an occasional dusting with a dry cloth or washing with mild soap and water. Where conditions are more severe, other methods may be needed to remove the deposited dirt and grime.

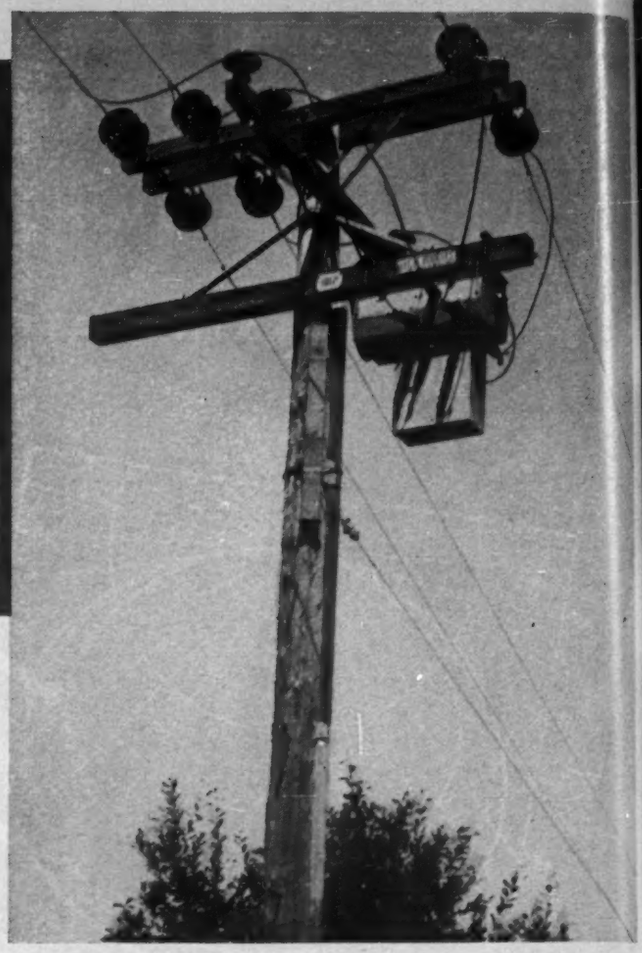
The glass-like hardness of the Alumilite finish (process patented) on Alzak Aluminum Reflectors makes cleaning easy. It won't chip and it doesn't scratch easily, assuring long life with continued high efficiency.

The book, "Instructions for the Protection and Maintenance of Alumilite Finishes and Alzak Reflectors", tells you how to keep these reflectors doing their best. For a copy, write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

*Registered trademark

ALCOA ALUMINUM

HERE'S INSTANT *FAULT* CLEARANCE

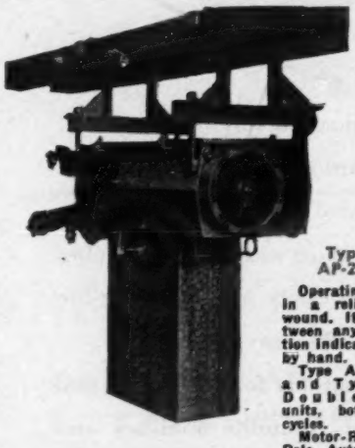


FOR RURAL OR LOW-REVENUE DISTRIBUTION LINES

PACIFIC ELECTRIC'S

Automatic Service Restorer

ENDS MOST LONG OUTAGES THAT SO OFTEN FOLLOW BLOWN FUSES



Type AP-1, Type AP-2, Hand-Wound

Operating energy is stored in a reliable spring, hand wound. It can be rewound between any faults. Has position indicator. Can be tripped by hand.

Type AP-1, 7.5/12.5Y-kv., and Type AP-2, 15-kv., Double- and Three-Pole units, both 100 amps., 60 cycles.

Motor-Rewound and Single-Pole Automatic Service Restorers also available.

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Other Representatives in Principal Cities

Pacific Electric's Automatic Service Restorer offers excellent continuity of service for rural or low-revenue distribution lines.

Its low first-cost and low upkeep bring the Service Restorer well within the operating economies of the system.

With it, most of the long outages that so often follow fuse protection are eliminated.

You get three automatic reclosures on transient or sustained faults before it locks out on the fourth opening.

At anytime between faults, the line patrolman can easily hand-rewind the operating spring and again you have a cycle of three-reclosure protection. No auxiliary power supply needed.

As all poles of the Service Restorer open together, single-phase operation of three-phase equipment and dangerous feed-backs are prevented. You get a selection of predetermined closing-time intervals. As for safety, good design and long lasting construction, *all of that* has been proved on scores of utility lines the nation over.

For full details on instant clearance of faults on rural or low-revenue distribution lines, write today.

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

Sangamo Capacitors Can Take It!
Climatic conditions, under which various communications equipments are operated, vary from the sub-zero temperatures of the northernmost climates to the tropical temperatures encountered at the equator. Conditions of humidity cover the extreme range; from the dry arid regions of the many deserts, to the almost 100% humidity in tropical and sub-tropical atolls.
It has been the problem of Sangamo engineers to design and produce capacitors that perform faithfully under these varying conditions, and so assure vitally needed communications at all times.
The wide variety of capacitors illustrated insures the availability of the proper unit for almost any mica capacitor requirement.
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS
MICA CAPACITOR
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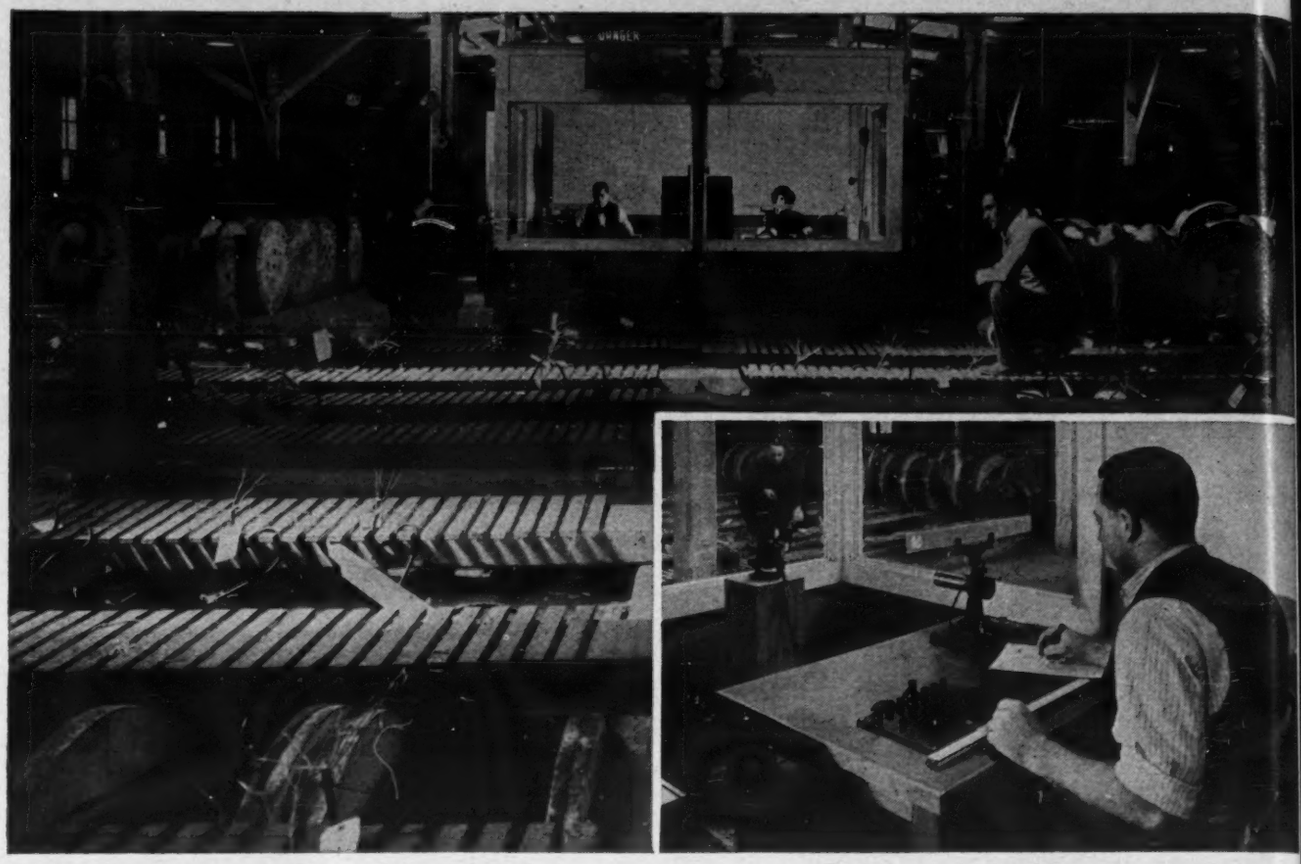

INSULATION TESTED QUICKLY & ACCURATELY BY U. S. RUBBER CO., WITH L & N INSTRUMENTS

A cable-testing department which features convenience and safety, as well as accuracy, is shown in these views of a United States Rubber Company test area at Bristol, R. I. The test being conducted is ASTM Spec. D-257-38, "Methods of Test for Insulation-Resistance of Electrical Insulating Materials".

Reels of cable are immersed in tanks below floor level, and are reached by means of the cat-walks. In the test booth each operator is seated before a No. 5602-A2 Guarded Insulation-Resistance Test Assembly, to which leads are run from the exposed ends of the cables. Instruments are thus protected against the dust and dampness of the cable-handling area, yet the members of each test team can see each other at all times and testing proceeds with orderly speed and precision.

Features of Test Assembly

Each Assembly consists essentially of the Test Set, the Galvanometer and galvanometer-reading Lamp and Scale. The Test Set is shown here mounted flush in the table; the Galvanometer is on the timber post which rests on a pier independent of the building foundation.

In using the Set, the operator impresses the test voltage (max. 500 v) first on the Set's tenth-megohm standard resistor and then on the insulation; the galvanometer deflection is noted in each case and the insulation resistance computed therefrom. A guard circuit shunts all leakage currents around the galvanometer, so that only the current through the insulation can cause deflection, and no further precaution against leakage is required. Humidity has no effect, except on the dielectric under test. The Set contains an Ayrton shunt, for making the extent of galvanometer deflection convenient for the particular cable under test.

This Assembly differs from earlier ones in having no exposed switch contacts and in replacing the 2500-f Galvanometer (sensitivity 0.0001 μa; period 14 secs) with a No. 2500-b Galvanometer, whose sensitivity of 0.0005 μa is ample for routine tests and whose period is only 6 secs, thus greatly increasing the speed of operation. For the higher sensitivity required in research, the No. 2500-f Galvanometer is of course still available.

We will be glad to send further information regarding measurements under specific conditions.

Jrl Ad E-54-460(6)

depends on me!
A Slogan For Every American

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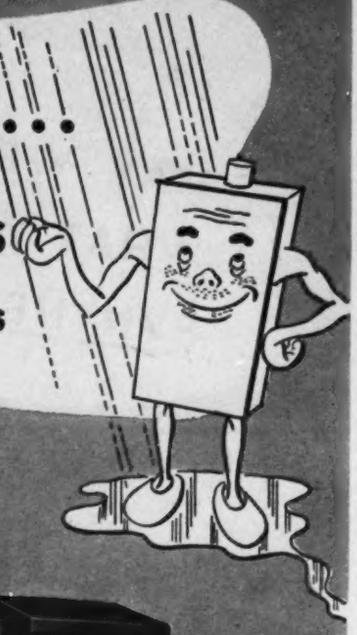
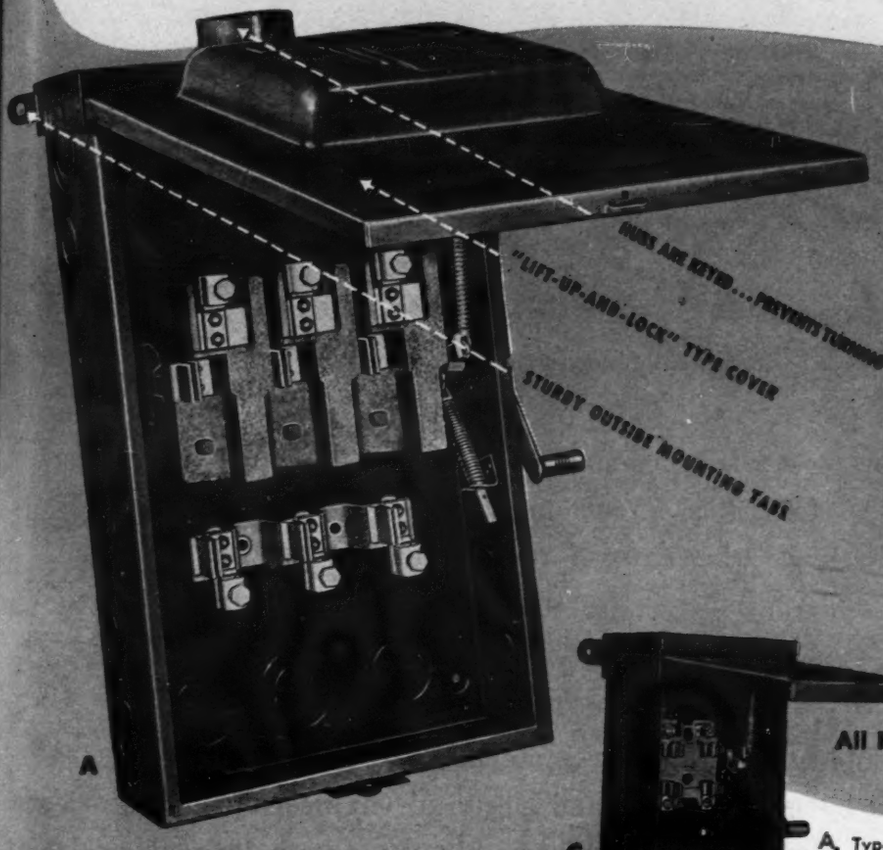
LEEDS & NORTHRUP
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

let it rain...let it pour...

Federal RAIN-TIGHT SWITCHES eliminate moisture worries





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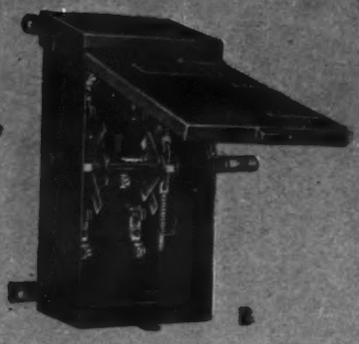

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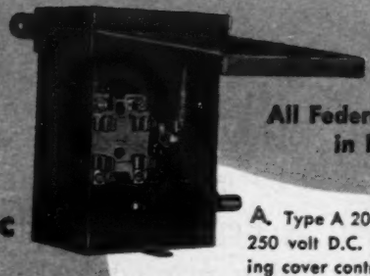

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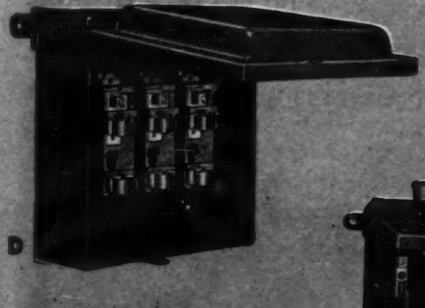

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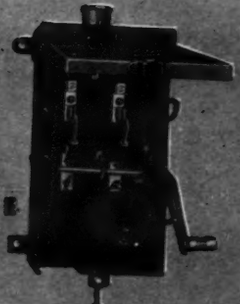


E

All Federal Switches are available in Raintight Enclosures

A. Type A 200 amperes 3 pole 230 volt A.C.—250 volt D.C. Switch. Equipped with interlocking cover control.

B. Double-throw 60 amperes 250 volt D.C. Safety Switch.

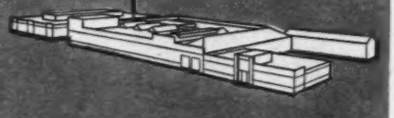
C. Type C 30 amperes 2 pole cartridge fuse 230 volt A.C.—250 volt D.C. Raintight Switch.

D. Type C 60 amperes 330 volt A.C.—250 volt D.C. All type C concealed arc switches are equipped with shock resistant Hemite bases.

E. Type C 100 amperes, 2 pole, 250 volt D.C., no fuse Raintight Switch.

Federal

ELECTRIC PRODUCTS COMPANY
50 Paris Street, Newark, N. J.



CIRCUIT BREAKERS • PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES

MAY WE *Share* WITH YOU WHAT WE HAVE LEARNED ABOUT SYNTHETIC RUBBER INSULATION

After approximately sixty years devoted exclusively to making insulated wires and cables, the skill that enables us to obtain the greatest values from new insulating materials has become second nature. That is why we so quickly developed new synthetic insulations and sheaths to replace special purpose, natural rubber compounds that have been used on Simplex wires and cables so many years.

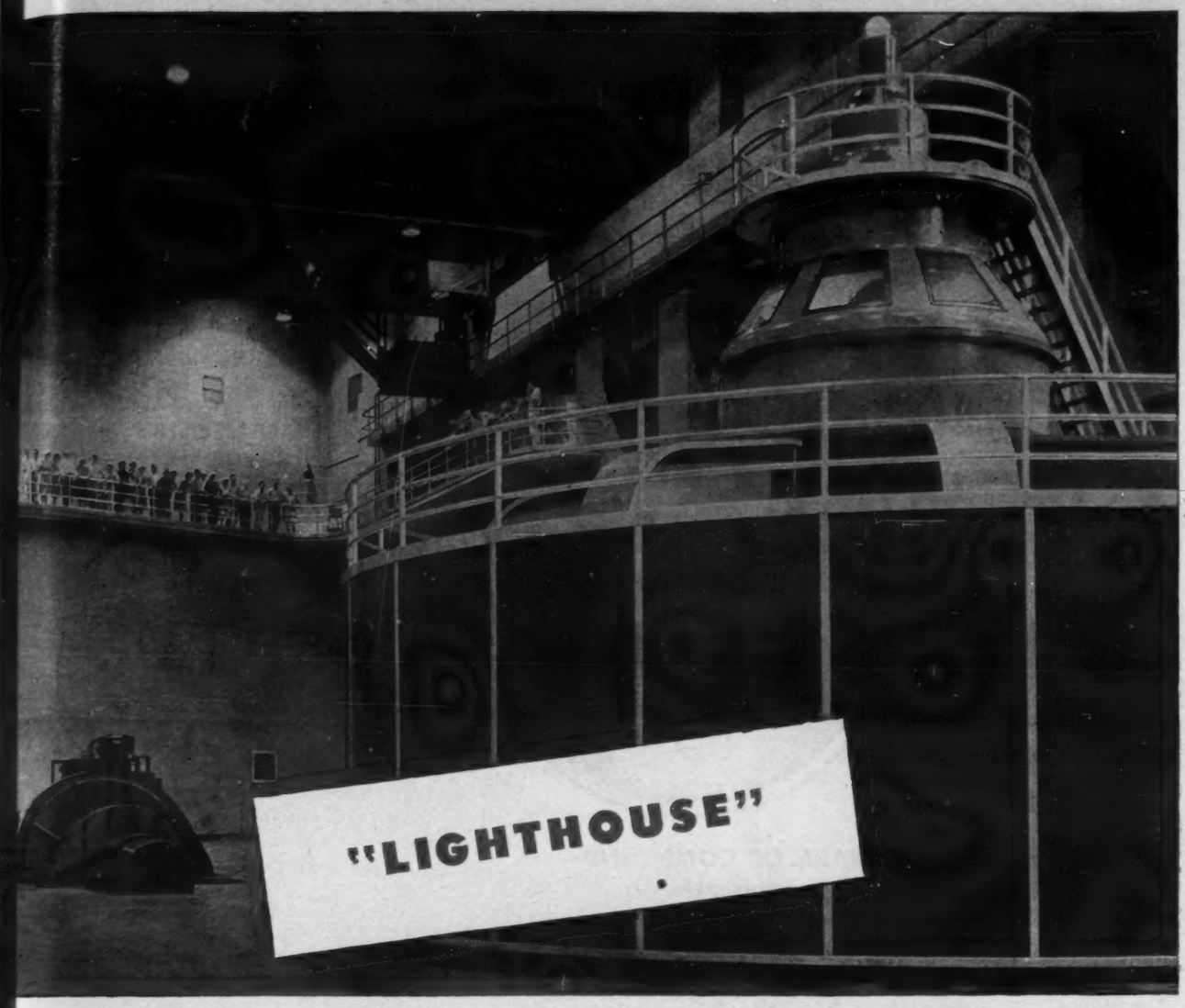
The change-over is now practically complete and various Simplex wires and cables that have been so favorably known now have synthetic rubber insulations and sheaths to replace the natural rubber compounds formerly used. Laboratory and service reports indicate that Simplex wires and cables as made today may be relied upon for the same satisfactory performance as in the past.

Because of the wide interest in the new materials we have collected the results of the work done by our chemical and electrical engineering laboratories in a booklet entitled "A Report to Industry on Simplex Synthetic Rubber Insulations." It is now being printed and we would like to send a copy to you as soon as it is off the press. Please ask for it by post card or letter to the Simplex representative nearest you or direct to us at Cambridge.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY (E) NAVY M★★★

Simplex WIRES and CABLES



IGHT for the far-flung farms and cities of Arizona, Southern California and levada, and power for shipyards, aircraft plants, and other industries will be rovided by huge generators like that own above.

This will be one of the greatest concentations of power-generating equipment the world . . . when the sixteen 115,000 water turbines are installed.

Not only in hydro-electric plants, but ore and more in *steam* plants, Texaco delivering more effective lubrication.

Texaco Regal Oils (R&O), a new high preventing rust and oxidation – keep steam turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. These oils free themselves rapidly from air and water, are highly resistant to gum formation and sludging.

Texaco lubricants have proved so effective in service that they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States.

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

NE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT – CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

What kind of Insulating Compound?

SHOULD BE USED IN POTHEADS, SPLICE BOXES & CABLE JOINTS

G & W "NOVOID"

The purpose of compound in electric cable terminating and jointing device is to fill the space around the insulated cables and connectors with a high dielectric medium — which medium will prevent ionization and help exclude moisture.

For better and safer compounding, use a thermometer and pour at the recommended temperature.

CHARACTERISTICS OF G & W "NOVOID" COMPOUNDS

LOW VOLATILE LOSS.
LOW DIELECTRIC LOSS.
CHEMICALLY INERT.
(*No acid or alkaline reaction.*)
LOW MOISTURE ABSORPTION.
VERY STICKY AND TACKY.

NO VOIDS

(This is a very important feature becau the chief function of compound is to fi space and eliminate voids.)

STEEL PAILS NOW AVAILABLE

Heavy steel pails permit convenient heating of the compound the pail. Melt a column along the side to serve as a vent befo applying heat to the bottom of the pail.

SELECT THE PROPER GRADE OF COMPOUND

Asphalt base compounds are made in three standard grades . . .

HIGH TENSION —

NOVOID "A"—relatively soft. Suitable for general use in potheads, joints and other devices which are completely closed and sealed.
NOVOID "C"—relatively hard. Recommended for hot climates or locations where the softer grade would migrate. Properly selected for devices which are not hermetically sealed or completely closed—such as straight through style potheads and ordinary splice boxes.

LOW TENSION —

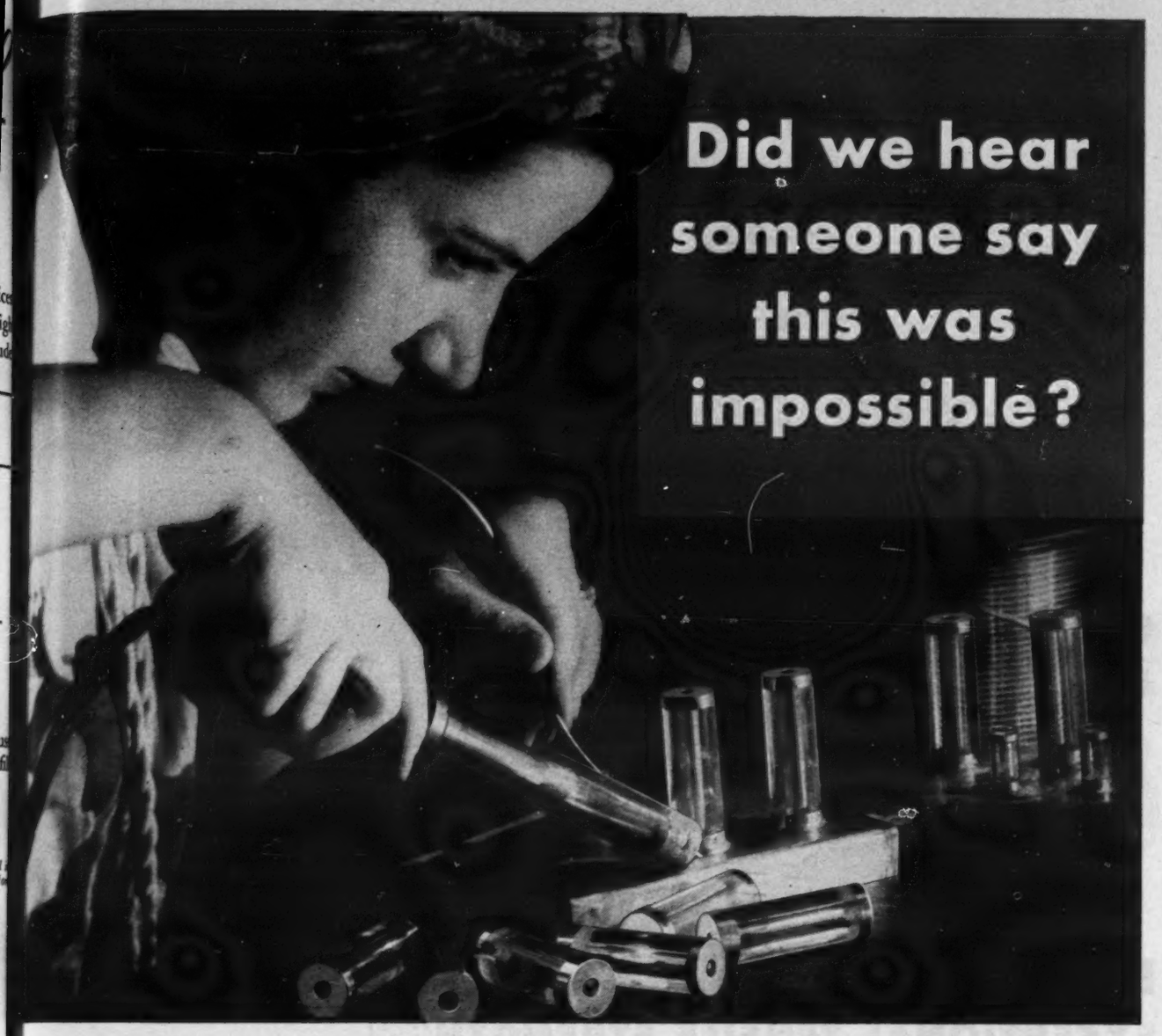
NOVOID "B"—relatively hard. Suitable for all general use in devices operating at 1000 volts or below.

NOVOID "X"—OIL INSOLUBLE

This new compound has all the advantages of the regular NOVOID compounds plus the added advantage of oil insolubility. This feature makes it desirable for use where there is a possibility of cable oil migration. Its very low volatile loss makes it a good space filler in potheads and cable joints.

1. Novoid "X" is practically insoluble in mineral oils such as used in cables and transformers.
2. Dielectric strength of Novoid "X" (900 volts/mil.) is almost three times that of transformer oil alone.
3. Coefficient of expansion of Novoid "X" averages about 0.00035 per degree F.
4. Novoid "X" softens at about 160°F., but does not flow at this temperature.
5. Pouring temperature—275° to 320°F.
6. Novoid "X" can be furnished in varying grades of hardness. (Advise application when ordering. Special grades must be used at low temperatures to avoid cracking.)

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE
CHICAGO 19 ILLINOIS, U.S.A.
In Canada, Powerlite Devices, Ltd., Toronto



DOING what couldn't be done in glass has become a habit at Corning—and this is a good example. "You can't solder metal to glass"— they said. But Corning Research did it.

Now Corning has developed a metallizing method whereby the base for the solder becomes an inseparable part of the glass and so provides a permanent, air-tight seal. The metallized layer solders almost as easily to brass or copper and is not harmed by normal soldering temperatures. Parts can be soldered to it by any ordinary soldering iron, soft-air-gas flame or induction heating.

So important—Corning type metallizing can be applied to an extremely wide range of glasses. Where extreme resistance to thermal or mechanical shock is required it can be applied to Corning's tempered glasses. Where electrical characteristics are of first importance it can be applied to Corning's special low-loss glasses.

This unique method of metallizing is just one of the ways that Corning's knowledge and experience may some day save you time and money. If you'd like to know more about us, we have a suggestion. Send for the study, "There Will Be More Glass Parts In Post-War Electrical Products." It's free. Just write to the Electronic Sales Department W-7, Bulb and Tubing Division, Corning Glass Works, Corning, N.Y.

CORNING
means
Research in Glass

Electronic Glassware

T.M.REG. CORNING U.S. PAT. OFF. T.M.REG. PYREX U.S. PAT. OFF.

"PYREX" and "CORNING" are registered trade-marks of Corning Glass Works

INSUROK HAS EXCEPTIONAL TENSILE STRENGTH"

● Many a product designer has heaved a sigh of relief upon learning that INSUROK is a combination of "beauty and the beast"—that it not only has an attractive appearance but also has ample tensile strength to meet the requirements of scores of postwar products.

Because INSUROK is also light in weight, it is being used in dozens of wartime products, today—will provide competitive advantages for other types of products, tomorrow.

INSUROK, Molded and Laminated, is made in a wide range of grades and types—with combinations of characteristics which make it the preferred material for innumerable electrical, chemical, mechanical and decorative applications. Richardson Plasticians will be glad to work with you or your designer in determining the type of INSUROK best suited to your needs. Write for complete information.

Unless users are going to "baby" your product, it may be advisable to give it the advantages of INSUROK'S high tensile strength.

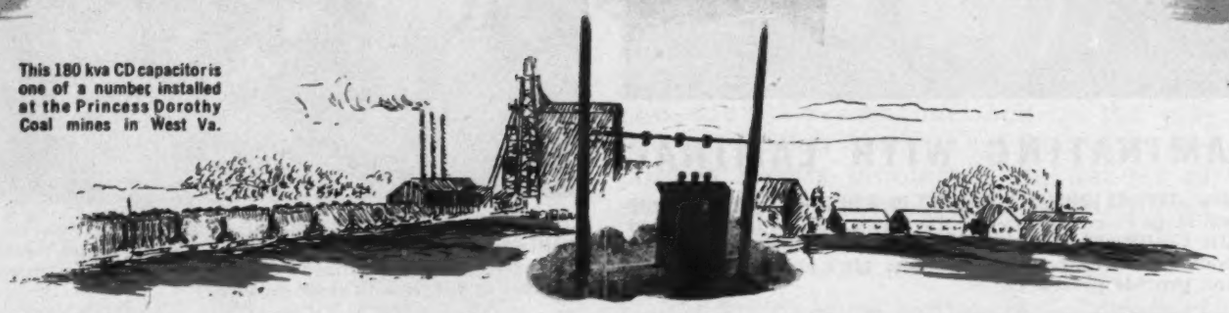
INSUROK *Precision Plastics*

The RICHARDSON COMPANY

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1868 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE 75 WEST STREET, NEW YORK 6, N. Y.

GET THE BEST FROM THE WORLD'S LARGEST

This 180 kva CD capacitor is one of a number installed at the Princess Dorothy Coal mines in West Va.

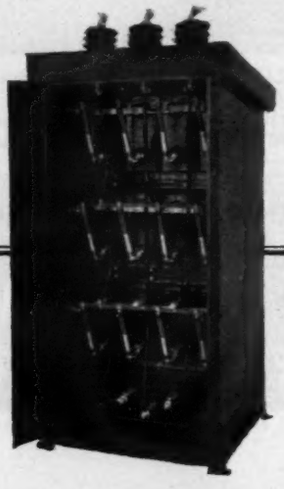


increase load carrying capacity of present system from 10% to 100%

Just like idle shuttle cars in a coal mine, low power factor is a waste of existing facilities. When new industrial installations along your lines call for more power quickly, turn to capacitors, as so many service companies are doing. Without adding new feeders or substation equipment, increases in load capacity of from 10% to 100% have been reported through the use of C-D Dykanol Capacitors. A C-D field engineer is near you . . . he will be glad to give you full information. Write today to Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Designed and Built by Specialists

180 kva, 2400 volt, 3 phase, 60 cycle dykanol outdoor pole or platform mounting capacitor. Accessibility of equipment in cabinet makes for ease of inspection.



CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

LIFE ON THE PLASTICS NEWSFRONT

(*Above*) **LAMINAC'S ABILITY TO ACT AS ITS OWN ADHESIVE** is one of its most valuable properties. Sections, such as the ends of this tank and laminated reinforcing ribs, are assembled by using the liquid resin as glue.

LAMINATING WITH LAMINAC

(*Above*) **TESTING LAMINATED AIRCRAFT DE-ICER TANK.** In fabricating such large complex shapes, the fabric base is impregnated with LAMINAC* and wound around a cellophane-covered wooden mold. Wrapping tension, plus shrinkage during cure, provide pressure.

(*Above*) **FABRICATING OPERATIONS** such as cutting, sawing or drilling, may be done at high speed. Physical and electrical properties vary according to organic or inorganic filler such as glass or fabric and resin content.

(*Above*) **LAMINAC LAMINATES** have a hard, smooth surface which can be machined to allow for inserts. LAMINAC has excellent dielectric strength, good dimensional stability and combines light weight with high structural strength.

Photos: Courtesy U. S. Rubber Company

(*Above*) **FLAT SHEET LAMINATES** are extremely simple to fabricate and can be used for a wide variety of applications. Here parts for use in aircraft are being cut from LAMINAC impregnated sheets.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION · 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

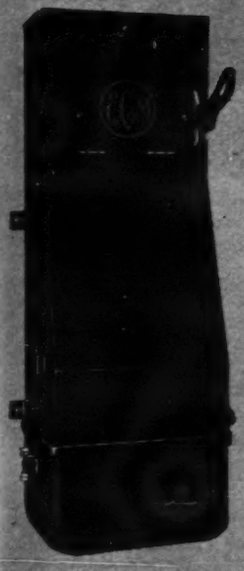
BEETLE · MELMAC · URAC · MELURAC · LAMINAC

ALL EC&M COMBINATION STARTERS ARE SAFE!

TOTALLY ENCLOSED-DOOR INTERLOCKED

For
WOUND-ROTOR MOTORS
2300 Volt Complete Starter

Reduced Voltage Squirrel-Cage Starter, 600 volts or less.



For
SQUIRREL-CAGE or SYNCHRONOUS MOTORS
Above: Full Voltage Starter for 2300 or 4600 volt motors. At left: 600 volt or less Full Voltage Starter.

WITH these EC&M combination starters you not only save ordering time, installation time, and materials, but also get shock-proof, safe units which can be mounted in a control room or out in the plant alongside the motors they control.

Each is completely wired, totally enclosed and equipped with interlock on the disconnect switch door. This small but important feature eliminates the danger of shock or burns to inexperienced help and also safeguards against the momentary mental lapse of an older employee.

EC&M builds these starters for all types of motors, for voltages up to 4600 volts, as well as for full or reduced voltage starting. Fill in the coupon below, checking the type of control suited to your needs and full information will be sent promptly. No obligation, of course.

FILL IN AND MAIL COUPON TODAY

THE ELECTRIC CONTROLLER & MFG. CO.
2700 East 79th St. Cleveland 4, Ohio

Gentlemen:
Please send me information on EC&M Combination Starters for

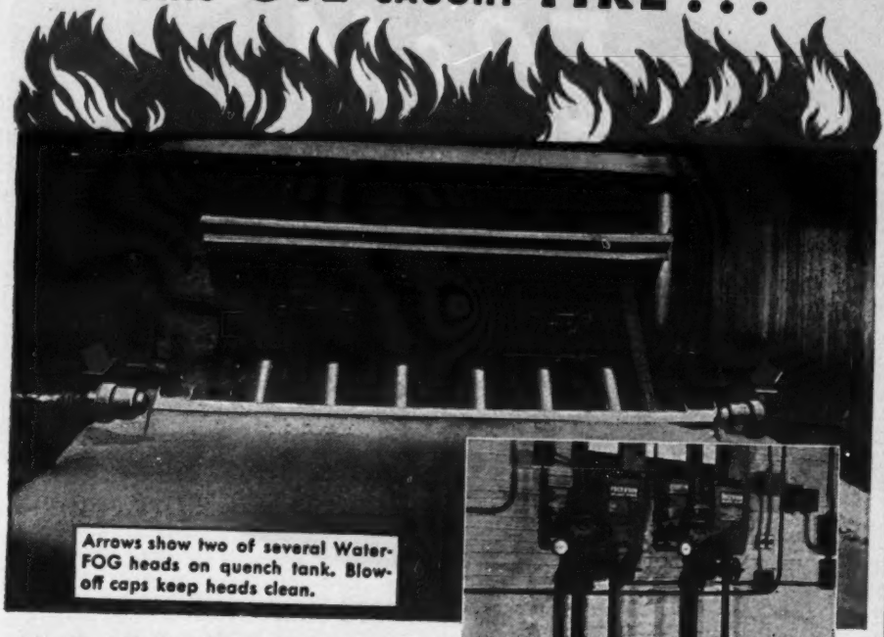
Reduced.....or Full.....voltage starting of a.....H.P., ...Volt Motor (Sq. Cage....., Wound-Rotor....., Synchronous.....)

Name.....

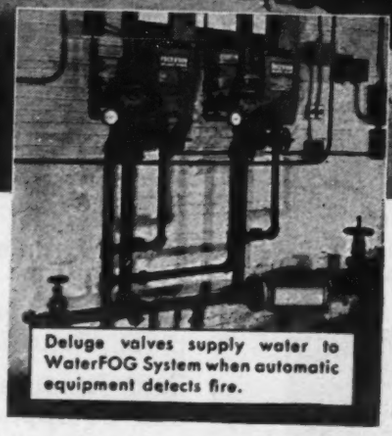
Company.....

Address.....

THIS OIL CAUGHT FIRE . . .



Arrows show two of several WaterFOG heads on quench tank. Blow-off caps keep heads clean.



Deluge valves supply water to WaterFOG System when automatic equipment detects fire.

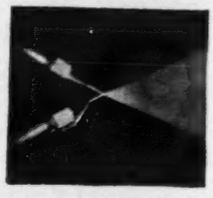
ROCKWOOD WaterFOG *Put it Out!*

4,000 gallons of oil in a quench tank . . . shell casings passing through, hot from the hardening furnace . . . and a WaterFOG System protecting against fire.

Suddenly a burst of flame . . . the entire surface ablaze! Just as suddenly . . . an all-enveloping cloud of fog . . . snuffing the fire, cooling the liquid. In no time at all, production resumed — no damage, only the merest delay, thanks to WaterFOG.

Such is the experience of a shell plant in Chicago . . . another in South Bend . . . another in Worcester . . . where oil quench tanks are WaterFOG-protected. And other flammable liquid hazards are similarly protected — transformers, paint shops, dryers, oil storage, etc.

WaterFOG, being *water*, is cheap, plentiful. Being *fog*, it is effective on flammable liquid fires where spray and solid stream are unsafe. It works faster, cools a wider area, doesn't splash. Both Underwriters' Laboratories and Associated Factory Mutuals approve Rockwood WaterFOG installations; the Navy, Coast Guard, Maritime Commission and Army, and hundreds of plants use WaterFOG — fixed piping and hose nozzles. Write for Bulletin 123.



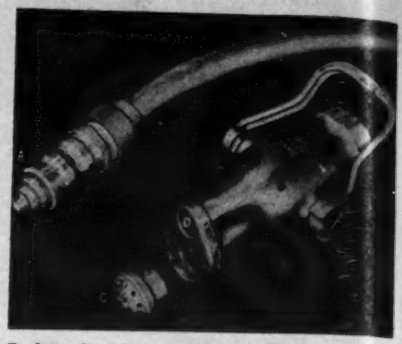
WaterFOG is— Water, broken into tiny foglets much finer than spray, by impinging streams from Rockwood nozzles. Floating over the combustion area, they absorb heat faster than spray or solid stream . . . cooling the fire, retarding vaporization . . . and changing into steam, shut off oxygen.

ROCKWOOD SPRINKLER COMPANY
62 Harlow St., Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

ROCKWOOD WaterFOG

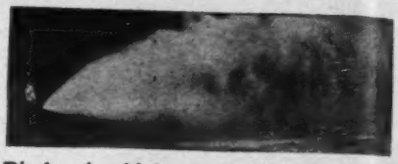
Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires

FOG for Cooling, Confining, Extinguishing or SOLID STREAM for Deep-Seated Fires



Rockwood's SG-40 Nozzle Projects Either—by a Quick Movement of the Handle!

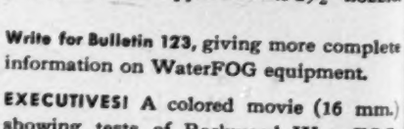
SG-40 Nozzle, and extension applicator for attachment to regular fire hose line. 1", 1½" and 2½" sizes.



Discharging high-velocity WaterFOG with considerable forward projection.

Moving the handle causes a solid stream to be discharged.

And for Fighting Fires Close Up—
FOG Tip being removed . . .
. . . replaced by applicator.



With extension applicator attached, SG-40 projects low-velocity WaterFOG in ball-shaped pattern. 4' and 10' applicators fit 1½" nozzle; 12' applicator fits 2½" nozzle.

Write for Bulletin 123, giving more complete information on WaterFOG equipment.

EXECUTIVES! A colored movie (16 mm.) showing tests of Rockwood WaterFOG, is available.

(Advertisement)

Flexible, curved-fingered B. F. Goodrich electricians' gloves make line work safer

Scientific design increases comfort—reduces danger

LINEMEN for years have been handicapped by the two pairs of protective gloves — one rubber, one leather — required for safety in most of their work. It was made tougher, too, because ordinary rubber gloves were — and still are — made by repeatedly dipping hand-shaped forms in a rubber solution; building up *layers* of rubber until the required thickness was reached. The layers made the gloves stiff, uncomfortable and awkward to work in. And any increase in awkwardness meant a decrease in safety.

Then B. F. Goodrich developed the Anode process by means of which hand-shaped forms are dipped in *pure liquid latex,* the needed thickness obtained in *one dipping.* No layers, no stiffness.

But B. F. Goodrich research men went a step further. They made a thorough study of the anatomy of human hands and then designed forms with *scientifically* — not arbitrarily — curved fingers.

This combination — Anode process plus scientifically designed forms — made possible electricians' gloves that set new standards of flexibility and comfort, and so, new standards of safety.

The B. F. Goodrich distributor or sales representative near you will be glad to show you a pair of these comfortable, safety-promoting gloves. Call him, or write *The B. F. Goodrich Co., Industrial Products Division, Akron, O.*

B.F. Goodrich
Electricians' gloves

ACCURACY OF DIMENSIONS INSURES EASIER ASSEMBLY OF THE FINISHED EQUIPMENT

• ILLINOIS Indoor Bus Support Porcelains shipped from this plant fully meet the purchasers requirements. You are assured of getting the following important qualities in every order whether in the smallest or largest sizes.

UNIFORMITY
EXACT DIMENSIONS
HIGH DIELECTRIC STRENGTH
HIGH MECHANICAL STRENGTH

Modern facilities, long time experience, production control through every step of manufacture, and step by step inspection make possible porcelains that get full user endorsement.

Specify ILLINOIS porcelain for dependability and economy

ILLINOIS INDOOR BUS SUPPORT PORCELAINS

ILLINOIS ELECTRIC PORCELAIN COMPANY *Macomb, Illinois*

NEW! RCA 2-Kw ELECTRONIC HEATER

FOR HIGH-SPEED UNIFORM HEATING OF NON-METALLIC MATERIALS.....

HERE'S a big advance in electronic heating—the new RCA 2-kw generator that automatically times the heating cycle, and automatically maintains maximum heating rate by compensating for changes in electrical properties of the heated substance as they occur.

Simple to operate! All you do to operate the RCA "2-B," once it is set up, is set the object to be heated on a plate (at top of unit), close the cover, and press the *start*-button. When the preset time interval expires, the power goes off and the cover pops open. It's actually "as automatic as your toaster."

Application: The RCA 2-B will deliver up to 6,800 BTU per hour. It is ideal for heating all manner of non-metallic substances —wood, plastics, rubber, chemicals, glass, ceramics—so long as composition is uniform. Where the material to be heated is in such form or so dimensioned that it does not fit the built-in applicator arrangement of the standard model 2-B, a modified type for operation with an external applicator system can be supplied.

The 2-B is ideal for heating plastic "preforms" before molding, and for quick curing of plastic-bonded wood parts. One pound of plastic material can be brought from room temperature to 275°F. in about 60 seconds.

Uniformity of Heating: This method of applying heat to non-metallic substances results in an even temperature rise all the way through the material; the center heats as quickly as the outside because the heat is "born" where it is needed. This result is achieved by passing high-frequency electricity "through" the material. The uniformity of heating makes it possible to heat at a high rate without developing "hot spots" within the material.

Power Demand: The power demand of the RCA 2-B is approximately 4 kw at 85% power factor when delivering full rated output. Standard 220-volt, single-phase 60-cycle power is required.

Write Today for further details, or for specific information about the application of electronic heat to your processes. RCA can supply standard electronic heating equipment in ratings up to 100 kw (340,000 BTU per hour). Send the coupon for free bulletins. *Radio Corporation of America, Electronic Apparatus Section* (70-47F), *Camden N. J.*

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION, CAMDEN, N. J.

LEADS THE WAY . . . in Radio . . . Television . . . Tubes . . . Phonographs . . . Records . . . Electronics

FREE

BUY MORE WAR BONDS

(Please Check)

- ☐ Bulletin on "RCA Electronic Generator Model 2-B"
- ☐ "Heating Wood with High-frequency Power" — 12-page semi-technical article.

RCA, Electronic Apparatus Section, Camden, N. J.
Gentlemen: Please send the items checked to:

Name.....

Company.....

Address.....

City.....State.....

70-47F

Nicopress

REINFORCING SLEEVES

for strengthening damaged Copperweld-copper conductors

Nicopress Reinforcing Sleeves offer an ideal means of strengthening Copperweld-copper conductors at points where one or two of the copper wires have been damaged. These sleeves are split the full length and may be slipped over the damaged section and compressed with the same Nicopress Tool used in making the regular line splice.

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

POINTS YOU HAVE ASKED ABOUT AIR COMPRESSORS ... BEFORE GETTING A SCHRAMM

DURABILITY?

A big point. Schramm Air Compressors are rugged ... suitable alike for rough, rocky travel and for soft muddy places ... withstand wear and tear.

VERSATILITY?

Versatile—yes! Power and Engineering Companies use Schramm for laying conduits and cables ... digging post-holes ... operating pneumatic drills and hammers ... breaking pavements ... supplying hoist, lifts, jacks ... cleaning engines and machines by jets ... plus many more uses.

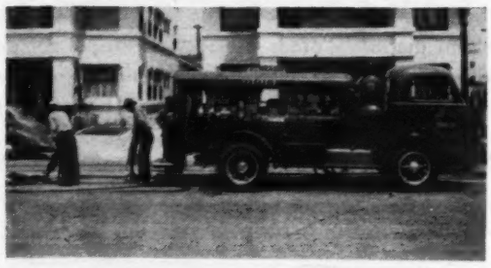
COOLING SYSTEM?

Ah, there's a feature! 100% watercooled, Schramm Compressors prevent overheating in summer, freezing in winter ... enabling them to work with doors closed (thus keeping out dust).

Schramm Air Compressors—both portable and stationary—are extensively used in general field service, generating stations, steam plants, repair shops.

Outstanding features responsible for this widespread use are: completely watercooled ... mechanical cam-operated intake valves ... larger discharge in head ... forced feed lubrication, to every moving part, through oil lines drilled in metal ... main bearings for each cylinder ... vibrationless ... safe, fast starting by push button ... compact and lightweight!

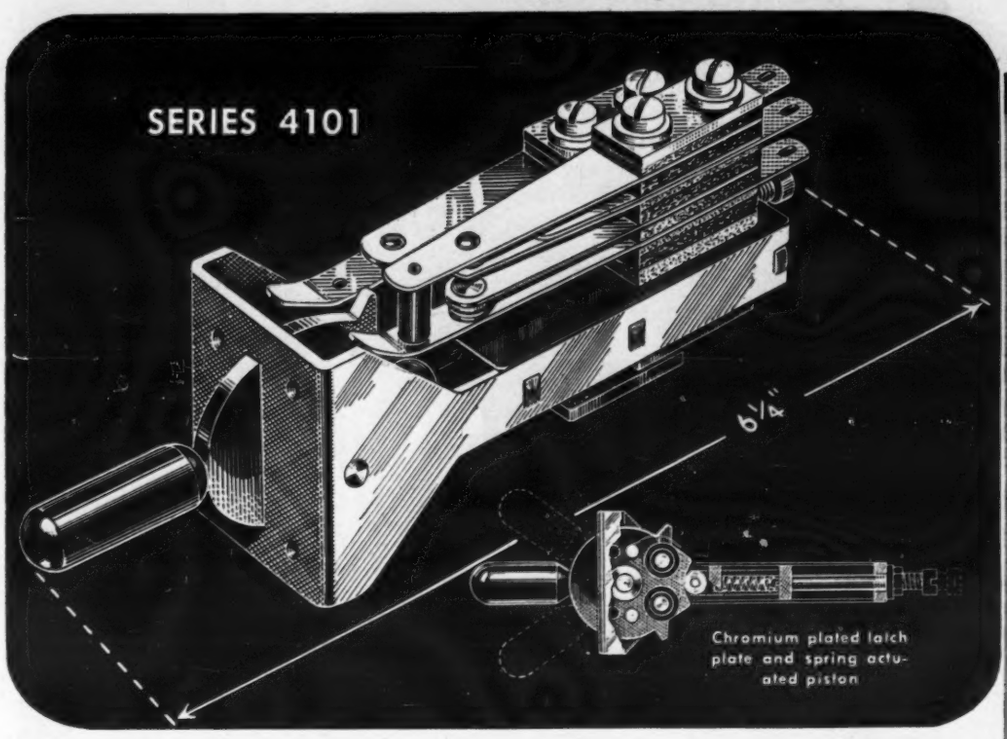
Get air when you want it by using a Schramm. For further details write for Booklet Pub-44.



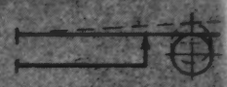
SCHRAMM INC.

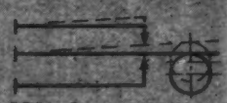
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

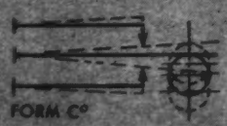
A Heavy Duty Lever Switch That Jar and Vibration Can't Shake Out of Locked Position



BASIC CONTACT FORMS







The Mossman 4101 Heavy Duty Lever Switch is a switch that stays put. Once locked in position, all the jar and vibration in the world won't shake it loose.

Such constant adjustment is made certain by the heavily constructed chassis . . . a heavy brass frame, rigidly braced. This supports a chromium plated latch plate and spring actuated piston in which a roller is mounted clevis fashion.

Stops are set into the latch plate to effect locking, non-locking and no-throw positions. Lever action can be supplied with changes from two-position to three-position; also from locking to non-locking and vice versa.

A rating of 10 amperes, 110 volts a.c. (non-inductive) is secured with standard heavy duty contacts of 3/16" diameter, fine silver. For extra heavy duty, a rating of 20 amperes, 110 volts a.c. (non-inductive) is secured with contacts of 5/16" silver alloy. Still other contact materials are available to meet special conditions.

Hundreds of combinations of contact arrangements are possible to meet specific needs as any combination of the six basic contact forms shown is available. Inverted forms may also be provided where space-saving is a factor.

Send for the Mossman catalog for complete description of the 4101 Heavy Duty Lever Switch and the many other precision electrical components in the Mossman line. These include many types of heavy duty multiple circuit lever switches, turn switches, push switches, plug jacks and special switching components.

DONALD P. MOSSMAN, Inc., 612 North Michigan Avenue, Chicago (11), Illinois

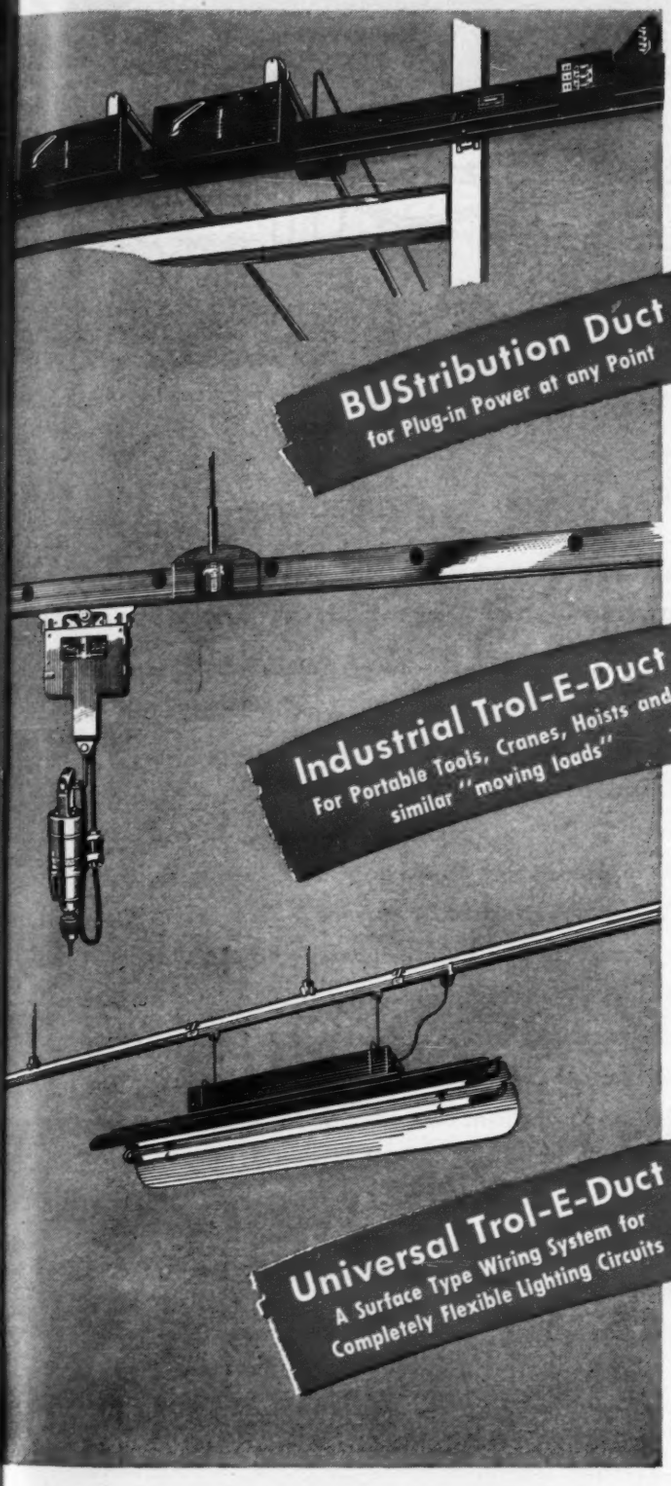
MOSSMAN

"Electrical" Components

3505 BULLDOG INSTALLATIONS

In America's Largest Manufacturing Plants

WILL SPEED RECONVERSION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Industrial Trol-E-Duct
For Portable Tools, Cranes, Hoists and similar "moving loads"
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A Surface Type Wiring System for Completely Flexible Lighting Circuits

BullDog Duct . . . for power and light . . . will help in Peace Production Race

In thousands of *major* U. S. war plants, new and old, BullDog Electrical Systems have saved countless hours on installation and maintenance — greatly reduced changeover time — helped keep production at top speed and efficiency.

How? By making plug-in power immediately available for any shop set-up. By bringing power close to portable tools on any type of production line. By putting light close to the work on any kind of operation.

An Asset in the Postwar Race

When these BullDog-equipped plants get the go-ahead for reconversion they will again be out in front in the production race — and for the same reasons. Their flexible electric systems will be ready for even the most sweeping changes of product, plant layout or tool set-up.

To manufacturers—large or small—who have not yet installed this modern method of power and light distribution, BullDog offers the services of expert field engineers, to help in planning postwar operations.

Write now for complete descriptive material on BullDog BUStribution DUCT, Universal Trol-E-Duct, Industrial Trol-E-Duct and other BullDog products.

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. . . for easier reconversion to peace loads— Westinghouse CSP Distribution Transformers

Because all apparatus needed for a distribution transformer installation is placed in one tank, the Westinghouse CSP can be moved in a fraction of the time and cost required to move an ordinary installation.

Westinghouse CSP Distribution Transformers ease the task of relocation. Completely Self Protecting (against lightning, short circuits and dangerous overloads), they offer *load adaptability* that will improve service continuity on the unpredictable loads in the days ahead. A signal light first warns of an overload, later the internal breaker trips if the overload continues and becomes dangerous. The maximum thermal capacity is *safely* usable at *all* times.

For complete information, call your Westinghouse office, or write for DD-46-100, Westinghouse Electric & Manufacturing Co., Dept. 7-N, East Pittsburgh, Pa.

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FLASHING LONG LIFE INTO POWER TUBES

IN transmitting tubes operating in military communications at ultra high frequencies, long life and uniform electron emission are imperative requirements. The photograph illustrates one interesting tube manufacturing operation with the tungsten filaments being "flashed" in a hydrogen atmosphere as a protection against oxidation.

North American Philips engineers build long life expectancy, optimum electron emission and all-round satisfactory performance into every NORELCO tube they manufacture.

Although all the tubes we produce now go to the armed forces, we invite inquiries from prospective users. A list of tube types we are especially equipped to produce will be sent on request.

In the North American Philips Company, there is gathered together a team of outstanding electronic engineers, captained by one of America's leading physicists, and coached by a group with world-wide experience resulting from fifty years of research and development in the electrical field. This new combination of technical talent has at its command many exclusive processes that insure electronic devices of the highest precision and quality. Today, North American Philips works for a United Nations' Victory; tomorrow, its aim will be to serve industry.

NORELCO PRODUCTS: Quartz Oscillator Plates; Amplifier, Transmitting, Rectifier and Cathode Ray Tubes; Searchray (X-ray) Apparatus, X-ray Diffraction Apparatus; Medical X-ray Equipment, Tubes and Accessories; Electronic Measuring Instruments; Direct Reading Frequency Meters; High Frequency Heating Equipment; Tungsten and Molybdenum products; Fine Wire; Diamond Dies. *When in New York, be sure to visit our Industrial Electronics Showroom.*

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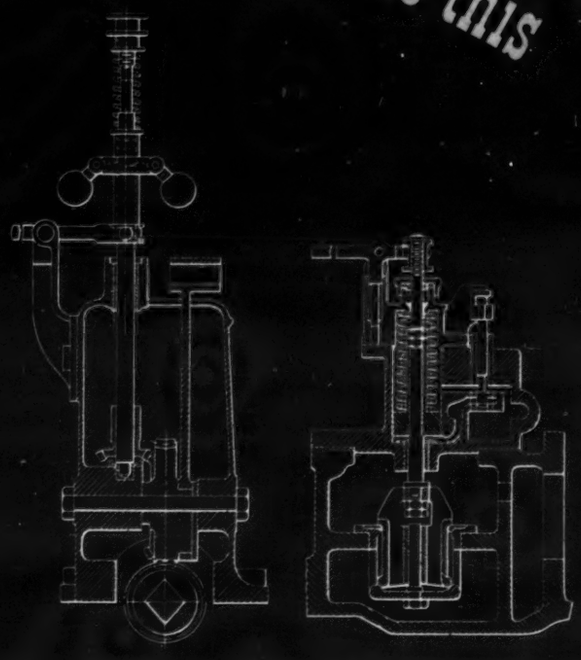
NORTH AMERICAN PHILIPS COMPANY, INC.
Executive Offices: 100 East 42nd Street, New York 17, N. Y.
Factories in Dobbs Ferry, N. Y.; Mount Vernon, N. Y.
(Metalix Division); Lewiston, Maine (Elmet Division)

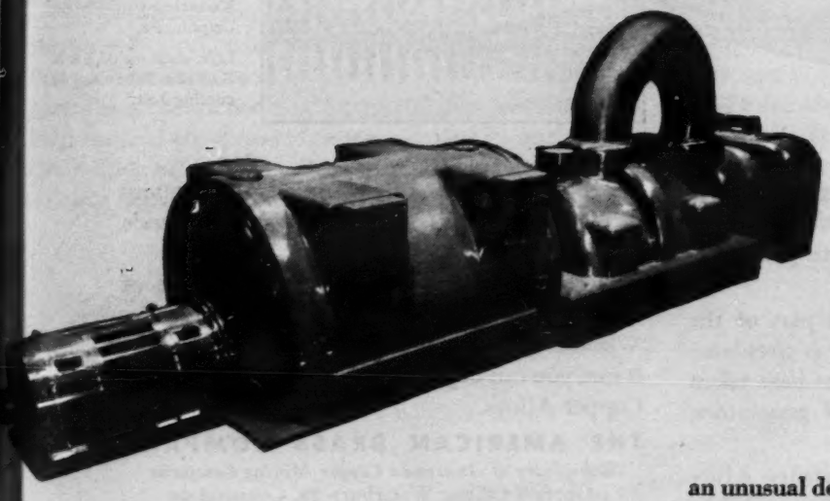
When GOVERNORS were made like this

Lubricating this "Cast Governor" of 1894 was no particular problem. Clearances were ample, mechanism simple. Steam was admitted in blasts, longer or shorter, according to the load on the machine. Attached to the spindle of the double-beat throttle valve was a piston which was normally pressed downwards by a spring above it. Steam leaking at a slow, but determined rate through the bushing of the spindle raised the pressure below the piston and so tended to keep the valve open in opposition to the action of the spring. The emergency shutdown device operated by releasing the steam under the piston of the double-beat valve, allowing the spring to hold the valve permanently shut. In modern types, oil pressure, instead of steam, is used to control the governor mechanisms.



a 1-Job turbine oil would do

..But modern governors need this 2-JOB oil!



The precision mechanism of the governors on today's turbines need an oil that will do more than just lubricate. They need an oil that *prevents rust* as well as one that *resists oxidation* to an unusual degree. Shell Turbo Oil does both.

SHELL TURBO OIL

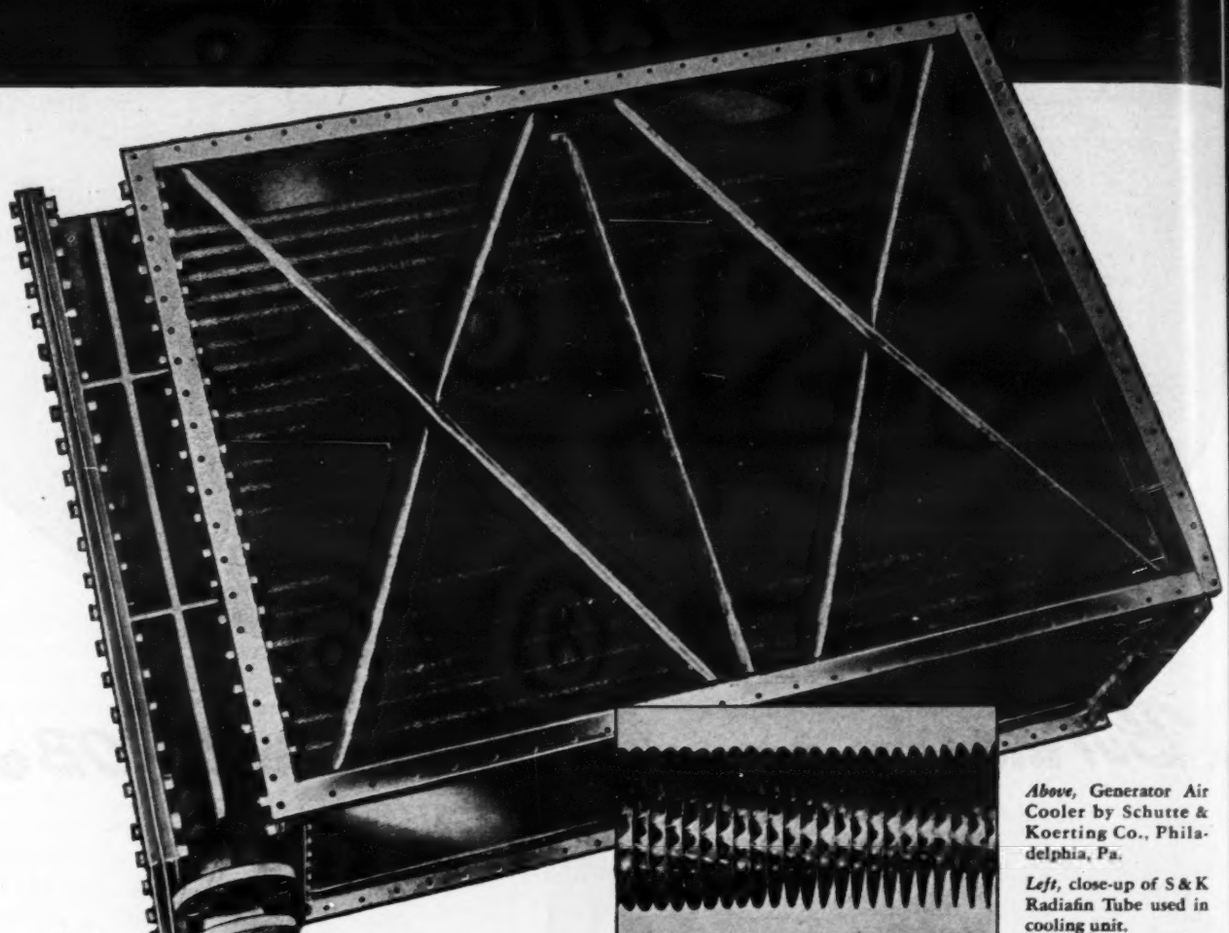
1. That prevents rust

2. That has superior oxidation stability

The governor on a modern turbine is, of necessity, built to such close tolerances that rust can stop it cold. That's why "that old reliable oil you've been using for years" is out of place in a modern, high-speed job. Today you need a turbine oil that does 2 jobs at once: (1) *prevents rust*, (2) *resists oxidation* to an unusual degree. Shell Turbo Oil does both. Why? Because it's designed for modern turbine use.

A smooth-running turbine today is no measure of tomorrow's performance. Don't wait for rust to strike. Change to Shell Turbo Oil. First of its type to be approved as meeting rigid U.S. Navy specifications, Shell Turbo Oil has built a reputation no turbine operator can ignore. Boasting? No! Facts prove it's so. Why not have a Shell man call and show you the record? Write: Shell Oil Company, Inc., 50 West 50th Street, New York 20, N.Y., or 100 Bush Street, San Francisco 6, Calif.

Anaconda METALS GIVE LONG LIFE TO GENERATOR COOLING SYSTEM



Above, Generator Air Cooler by Schutte & Koerting Co., Philadelphia, Pa.

Left, close-up of S & K Radiafin Tube used in cooling unit.

EXTENSIVE USE of Anaconda Copper and Copper Alloys contributes to the heat transfer efficiency and durability of Schutte & Koerting Generator Air Coolers.

In these coolers, which form a part of the closed system of ventilation, water is circulated through the tubes to remove excess heat taken by the air from the windings of generators, motors and converters.

Tubes are of Anaconda Admiralty Alloy wound with fins of Anaconda Copper and then tin-dipped to provide complete, continuous metal contact. Tube sheets are of Anaconda Muntz Metal.

Here is another example of the service of Anaconda materials in the field of heat transfer. Whether your problem is to put heat in or take it out, you can depend on Anaconda Copper and Copper Alloys. 44106

THE AMERICAN BRASS COMPANY
Subsidiary of Anaconda Copper Mining Company
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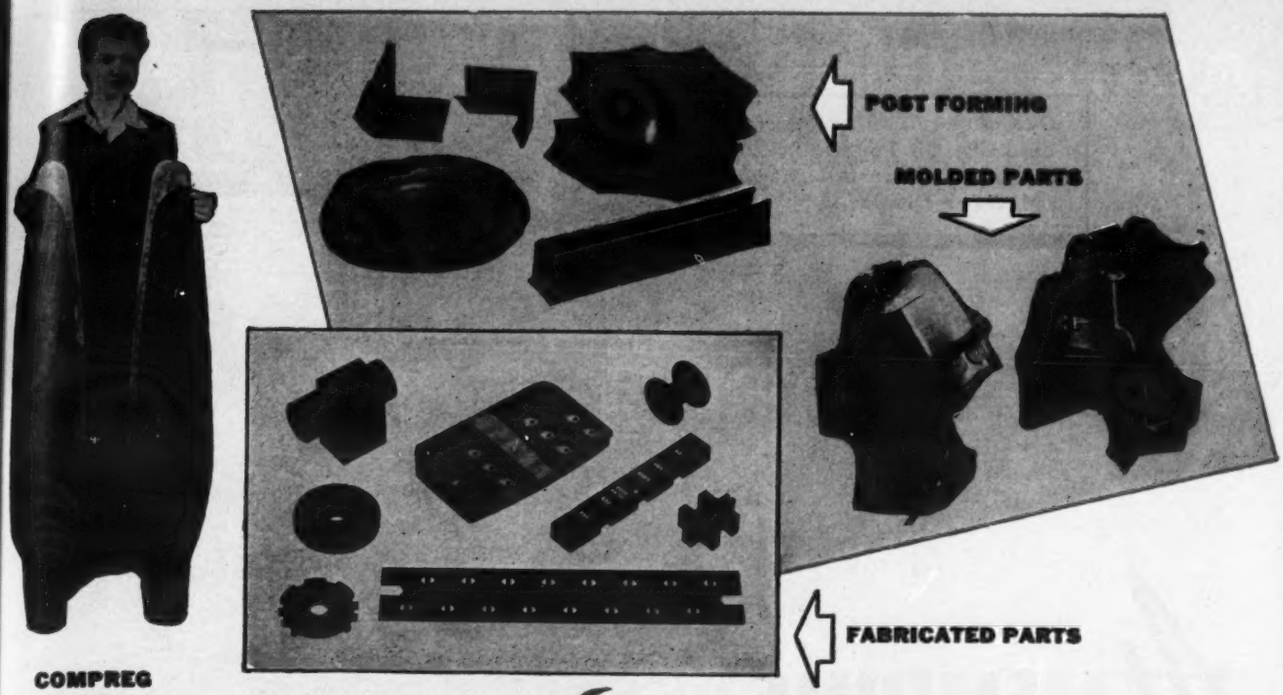
ANACONDA from mine to consumer

Anaconda Copper & Copper Alloys



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The nationwide organization of the Panelyte Division is a clearing house for authentic, up-to-the-minute information on structural laminated resinous plastics.

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New type plastics and improved molding and fabrication techniques, developed by our engineering staff, increase efficiency and cut costs on widely divergent applications.

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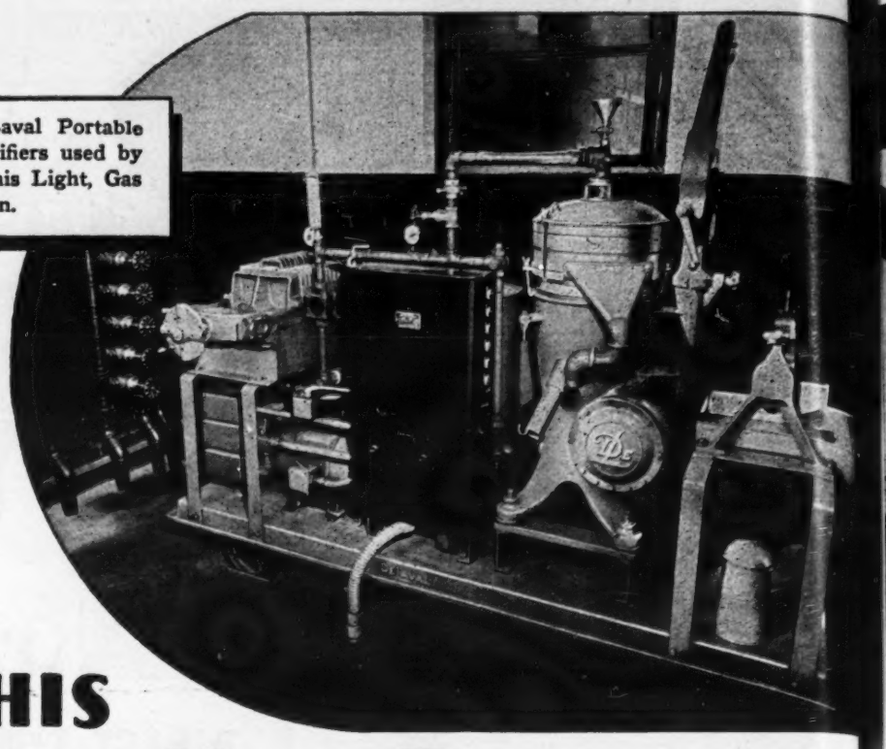
* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS



One of the De Laval Portable Insulating Oil Purifiers used by the City of Memphis Light, Gas and Water Division.

At MEMPHIS Low Cost High Efficiency Insulating Oil Maintenance

FOR nearly 20 years the City of Memphis has depended on De Laval Centrifugal Oil Purifiers to maintain transformer and circuit breaker oil at high dielectric strength. In addition to the Portable Oil Purifier shown, they operate a trailer-mounted unit for servicing large outdoor transformers.

De Laval Insulating Oil Purifiers such as these assure high-test oil at a single pass and at high capacity. Water is continuously discharged and oil is purified at relatively low temperature. High efficiency of purification is maintained during long runs.

Automatic oil flow control and thermostatic heat regulation make possible practically automatic operation. This feature is enhanced by the fact that the De Laval Oil Purifier does not require the aid of a blotter press in purifying transformer oil. (A press may be used in series with the purifier for removing colloidal carbon from circuit breaker oil.)

Write for additional details on the De Laval method of maintaining insulating oil—sent without obligation.

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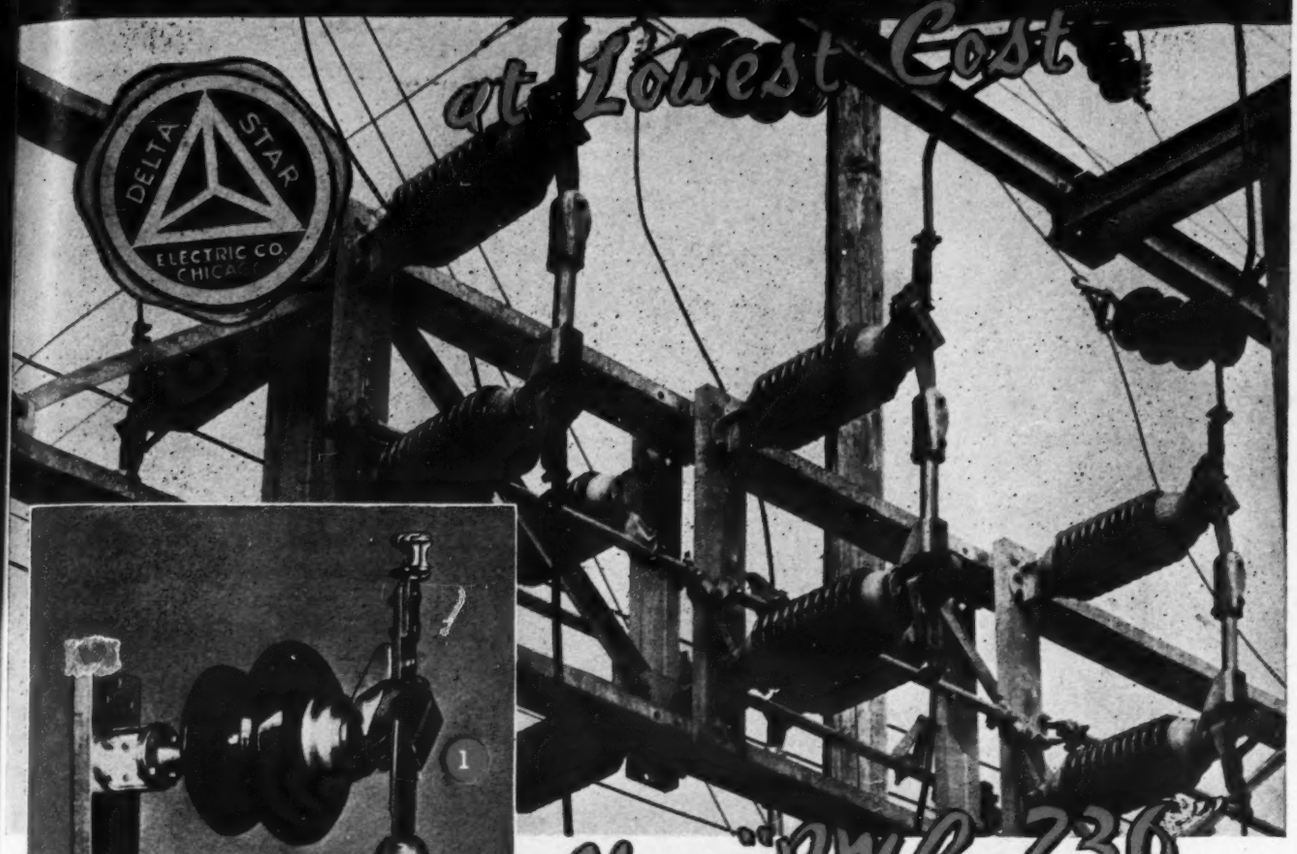
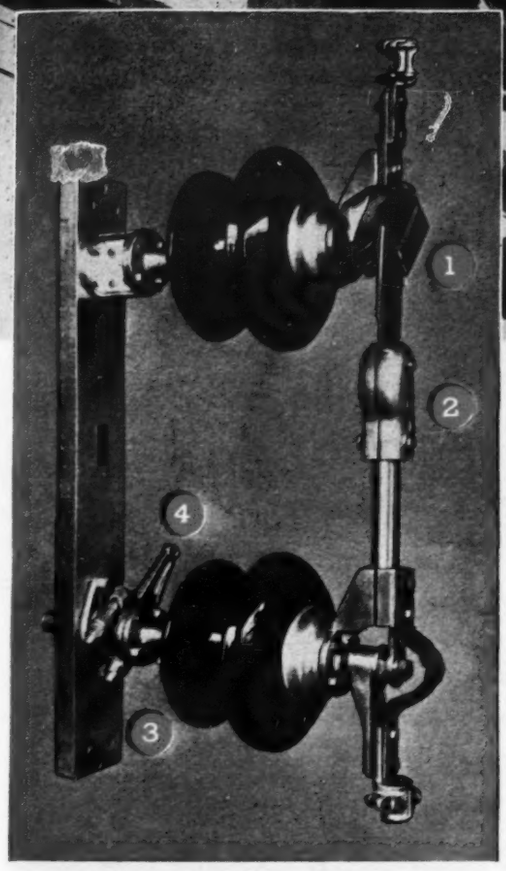
For Safe Remote Operation



at Lowest Cost



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There is a type for practically every outdoor application — whether for upright, inverted or vertical mounting.

CONSIDER THESE FEATURES

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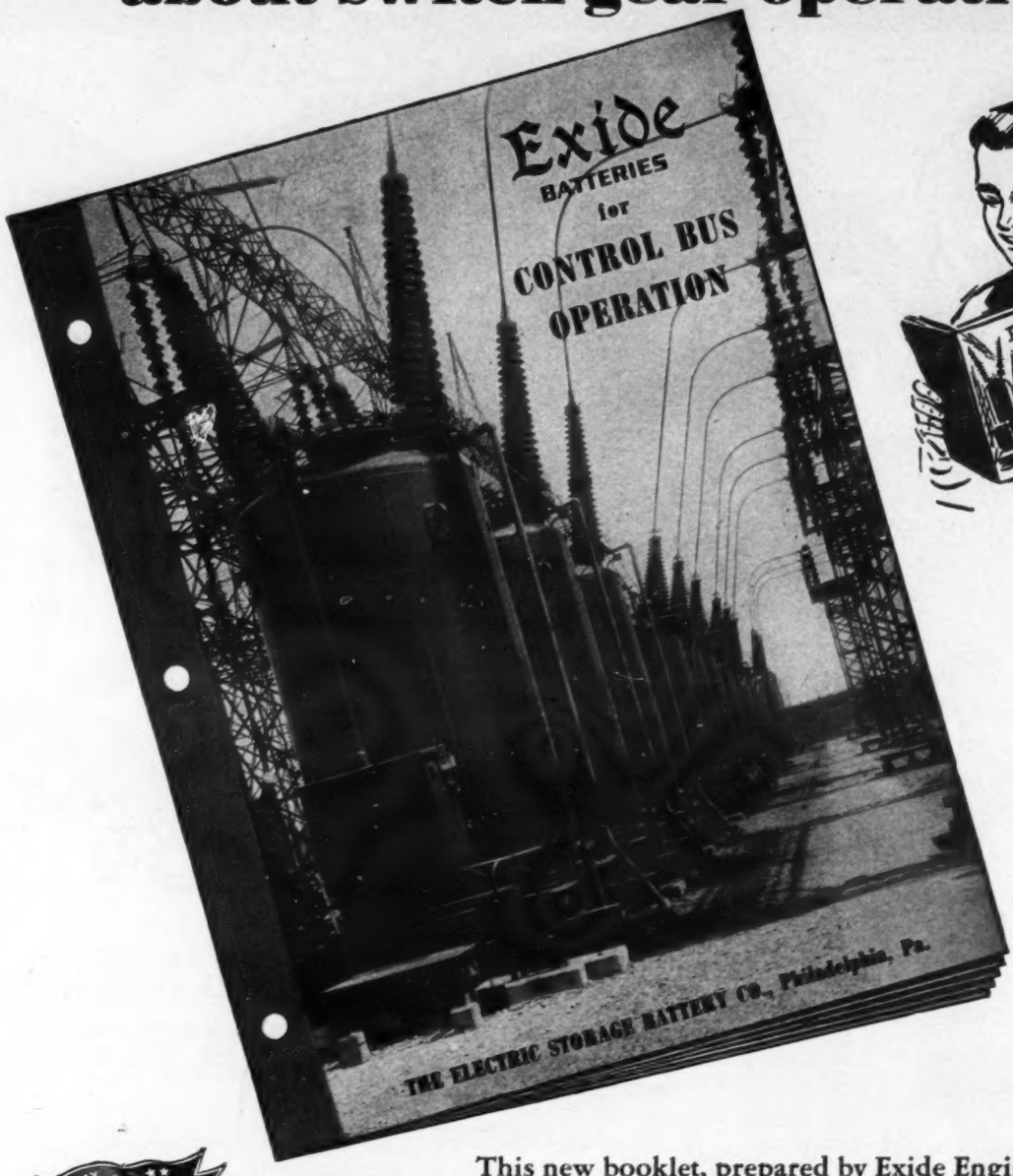
"Just what I wanted to know about switch gear operation."



ARMY E NAVY

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BATTERIES

Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability.

This new booklet, prepared by Exide Engineers, contains factual information of interest to all engineers engaged in the application of switch gear. The installation of storage batteries in power stations and substations has become standard engineering practice. This new booklet not only tells how to attain adequate and uninterrupted current supply, but gives complete information on types of batteries used . . . selection of battery . . . method of operation . . . maintenance and charging . . . and many other facts you should know. If you are interested, write for a FREE copy today.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
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Relentless RESEARCH

FOR BETTER ELECTRICAL CONNECTORS

Section of Burndy's test laboratory

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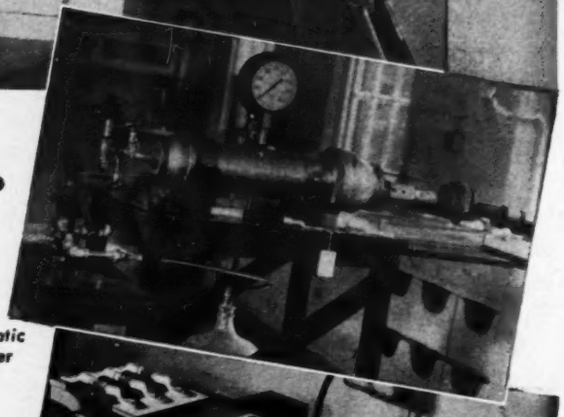
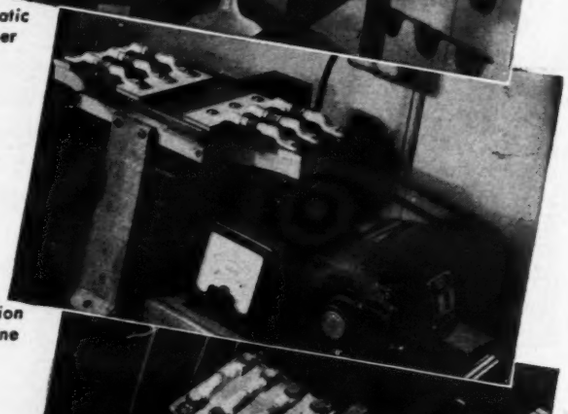
At Burndy, the development even of a small, special connector, means more than mere drawing board technique. It starts right from *bed-rock*... because only through complete laboratory findings on materials, design, and performance, can service efficiency be assured.

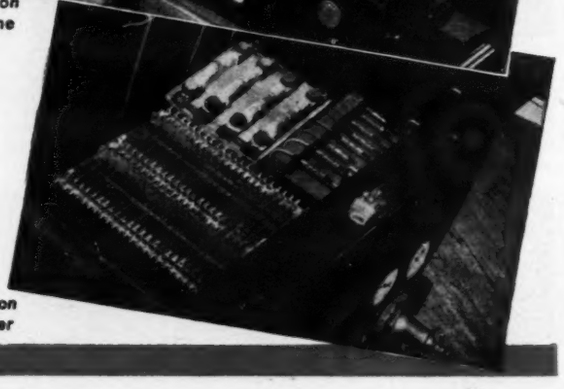
The constant, relentless research here in Burndy's completely equipped laboratory explains why so many outstanding connector developments stem from this source... and why industry relies on Burndy for the correct solution to any connector problem. Feel free to use this service at any time!



Hydrostatic Chamber



Vibration Machine



Corrosion Chamber

Headquarters for CONNECTORS

Burndy

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107 BRUCKNER BOULEVARD, NEW YORK 54, N. Y.
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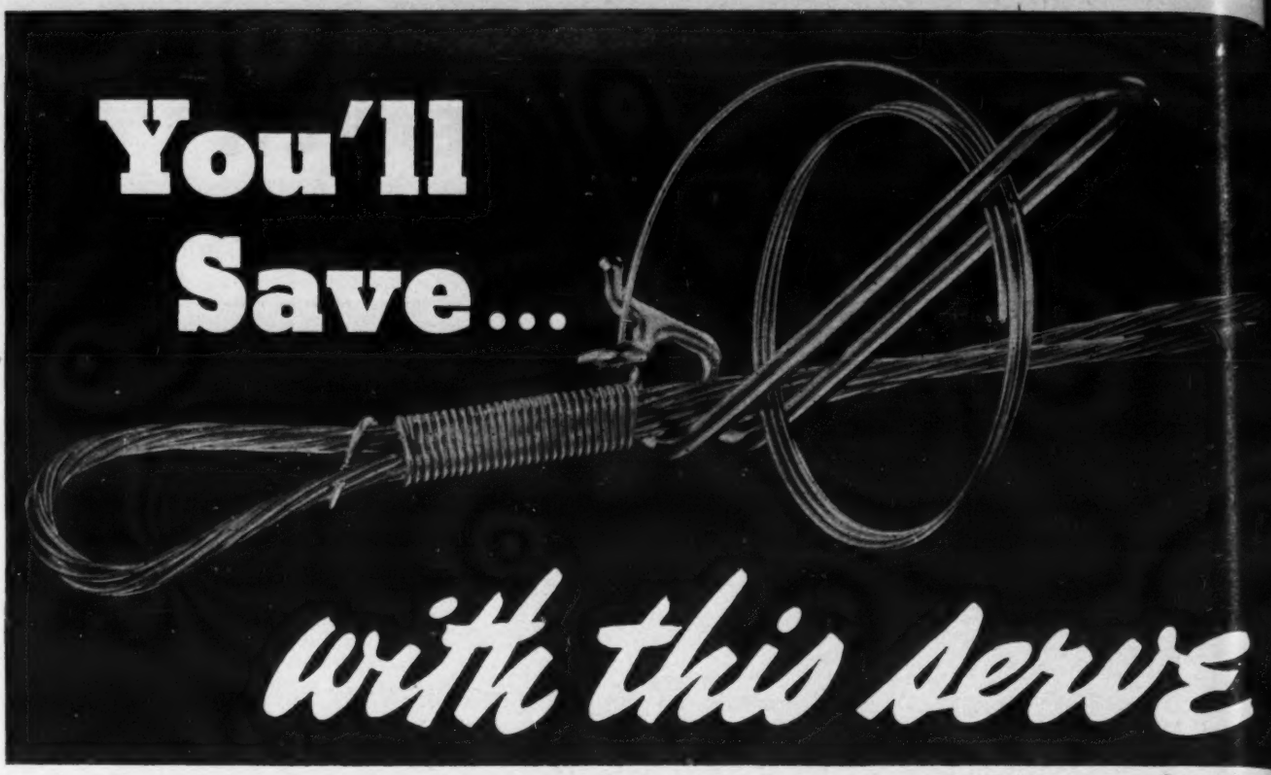
You'll Save... with this serve



Patents Pending

As every lineman knows, there have been two ways to make serves on dead ends of multiple zinc-coated strand on telephone and power lines.

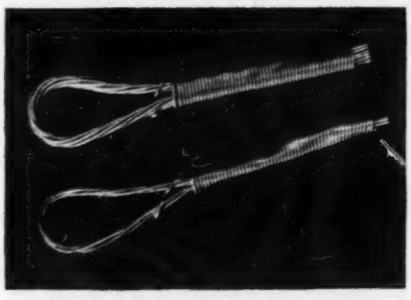
One method is the familiar "breakdown serve,"—a laborious job which, when made with pliers, tends to invite corrosion by damaging the zinc coating of the wires. The other way is the use of clamps.

Now Bethlehem's research engineers have developed a handy serving tool which provides a brand-new technique for making serves, on bethanized strand or Ruralductor. With the tool, which is a simple, one-piece winding appliance, any lineman can quickly master the technique—called the "dead-end coil" method because it uses a 10-ft. coil of dead-end wire to make the serve.

The new-type serve is a strong, tight wrapping of 11-gauge bethanized dead-end wire, given fifty turns around the ends of the loop. The wire is easily applied: the lineman simply engages it between the two "fingers" projecting from the tool, which hold it under steady tension while the tool is rotated.

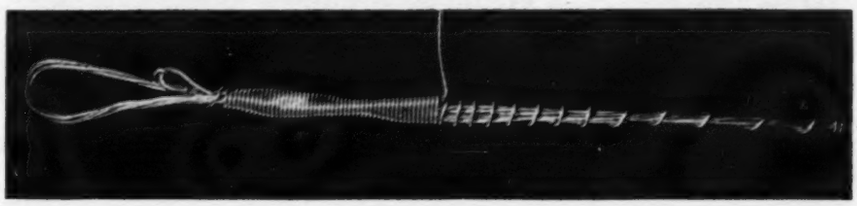
The ductile, tight zinc coating of bethanized wire or strand is not displaced to any harmful extent by the smooth, hard "fingers"—and tests show that the serve holds beyond the useful strength of the strand. However, the technique is recommended for use only on bethanized strand, as the holding power of the dead end is not always as reliable with other types of coatings.

For your next installation, give some thought to the advantages of bethanized strand, plus the Bethlehem serving tool. For complete information, get in touch with the nearest Bethlehem representative, or write direct to Bethlehem Steel Company, Bethlehem, Pa.

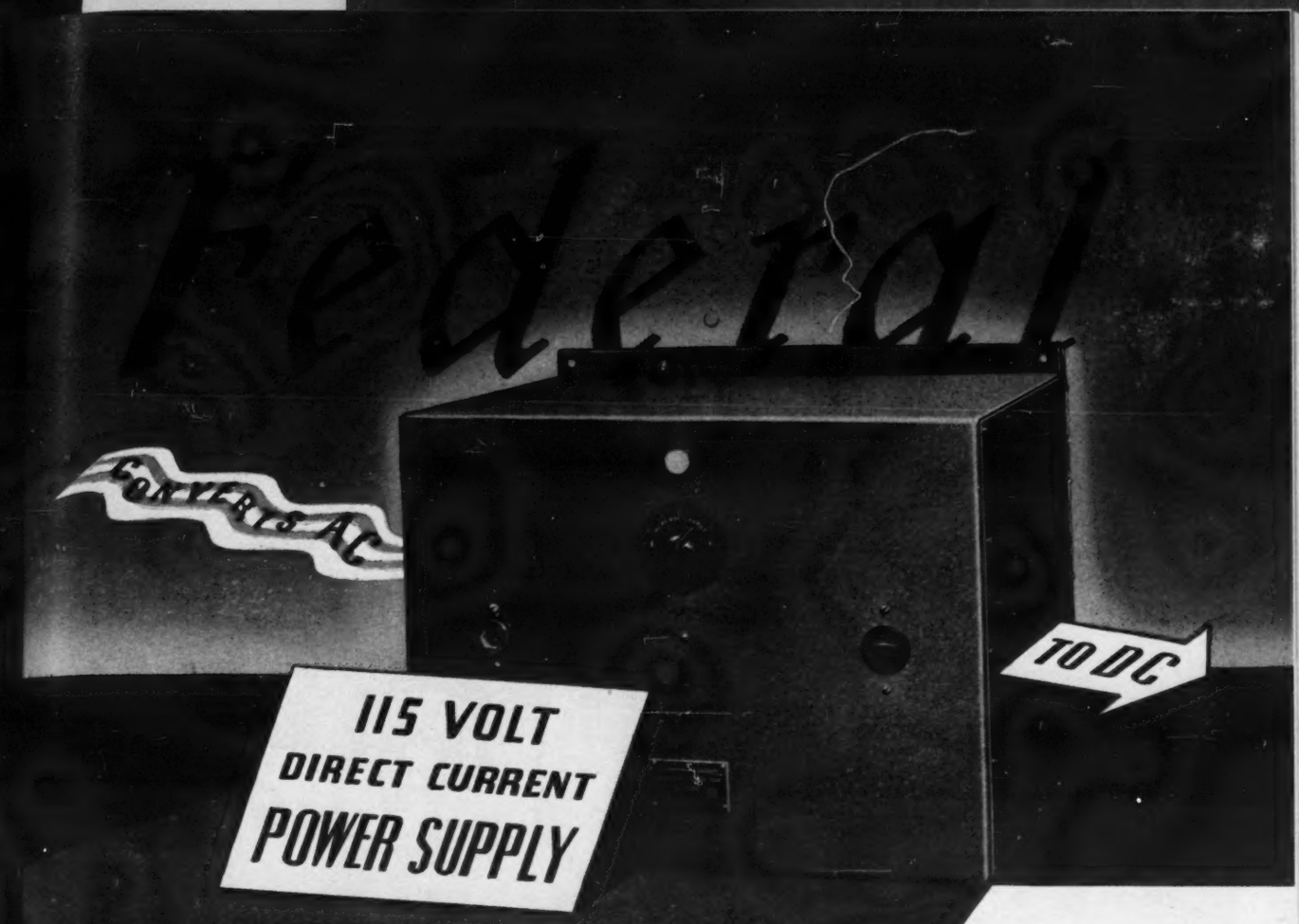


SERVES ON 3- AND 7-WIRE STRAND—These dead ends were quickly made with the new Bethlehem serving tool. The wire used is 11-gauge bethanized. The tool is suitable for the commonly used sizes and grades of strand, in class A, B and C coatings.

VIBRATION-DAMPENING ASSEMBLY—For this vibration-dampening dead-end assembly on three-wire Ruralductor, jumper wire of soft steel is laid in the valley between strands, and fifty turns of dead-end bethanized wire applied with the tool. The jumper wire is thus firmly secured, without interfering with the holding power of the dead end, and with good electrical contact. The individual strand wires are fanned back below the serve, and cut to lengths of 1 in., 5 in., and 10 in., respectively. The remaining dead-end wire is wrapped by hand. This provides an effective vibration-dampener.



★ BETHLEHEM STEEL ★



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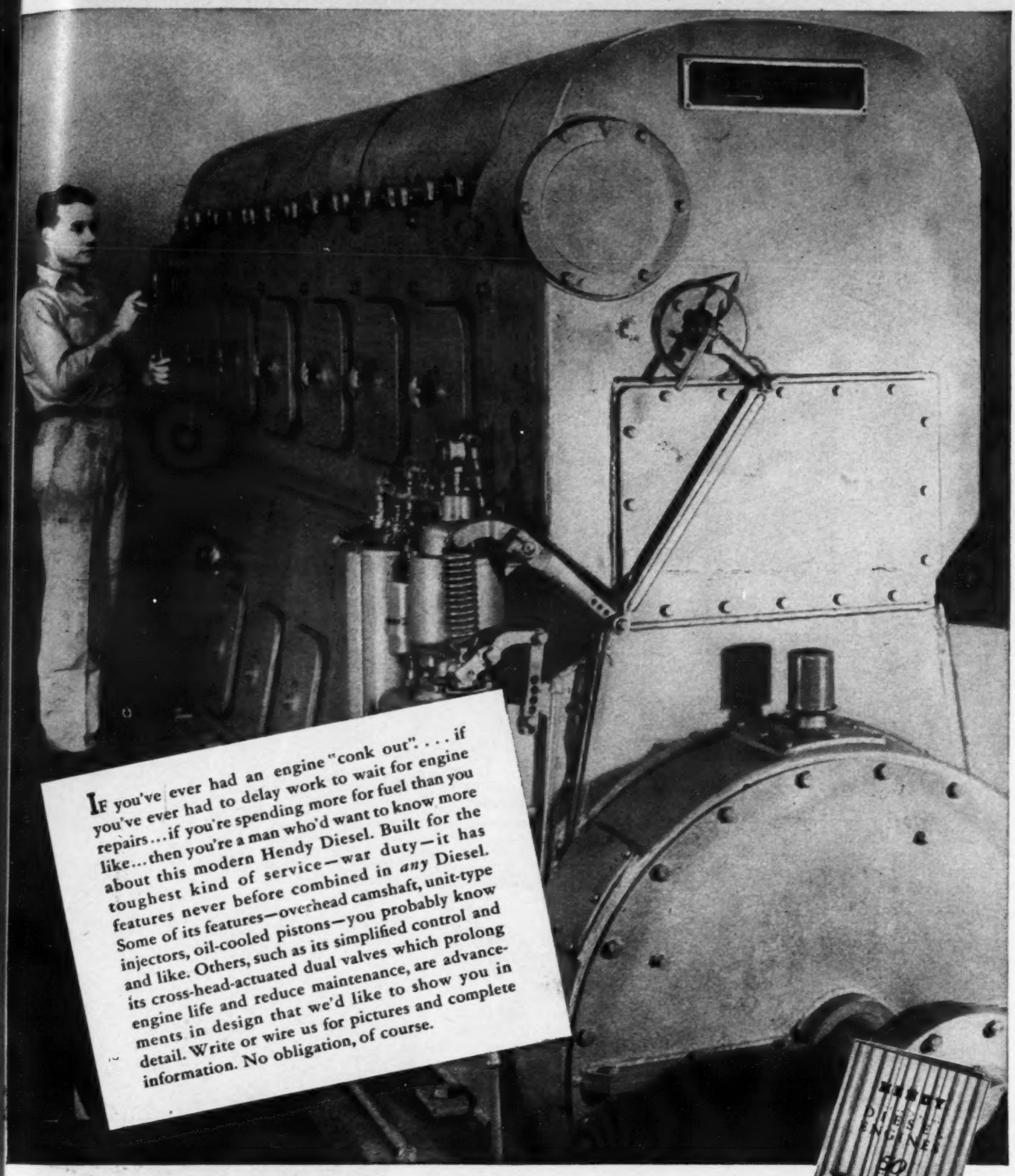
Telephone Lines on Bougainville

THIS is a war of communications. The farther our forces advance, the more wires, telephones and switchboards they need. And war stopped the making of telephones for civilian use.

We regret that many here at home cannot now get telephone service and may not be able to get it for some time.

If you are one of those who are waiting, we'd like you to know that we will do everything in our power to minimize your delay.

BELL TELEPHONE SYSTEM



IF you've ever had an engine "conk out". . . . if you've ever had to delay work to wait for engine repairs . . . if you're spending more for fuel than you like . . . then you're a man who'd want to know more about this modern Hendy Diesel. Built for the toughest kind of service—war duty—it has features never before combined in *any* Diesel. Some of its features—overhead camshaft, unit-type injectors, oil-cooled pistons—you probably know and like. Others, such as its simplified control and its cross-head-actuated dual valves which prolong engine life and reduce maintenance, are advancements in design that we'd like to show you in detail. Write or wire us for pictures and complete information. No obligation, of course.

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Specifications—6 and 8 cylinders; 4-stroke cycle; 12" bore; 15" stroke; 350-675 hp.

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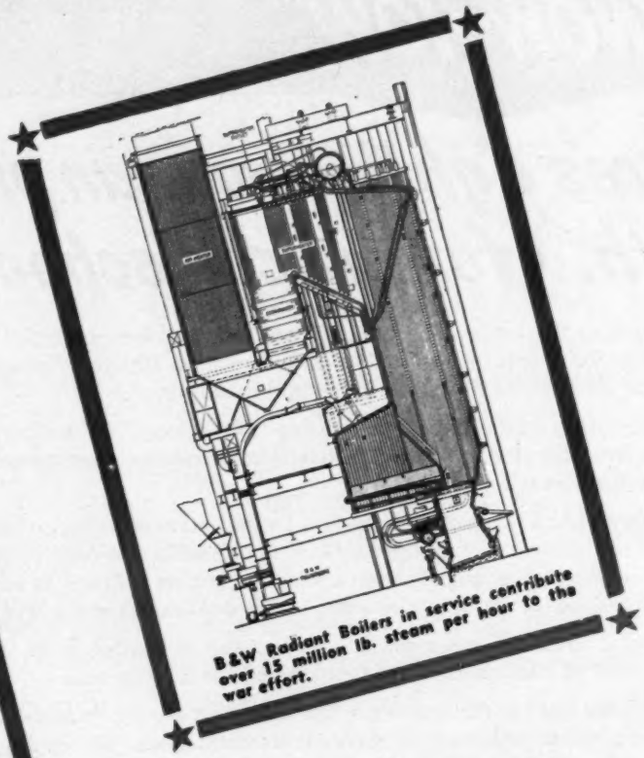
ATTACK...with POWER

What's back of the smashing offensive that is carrying the war to the Axis? The dynamic energy of management and labor . . . the amazing ingenuity of engineers . . . and, not least, the gigantic load shouldered by our public utilities and industrial power plants.

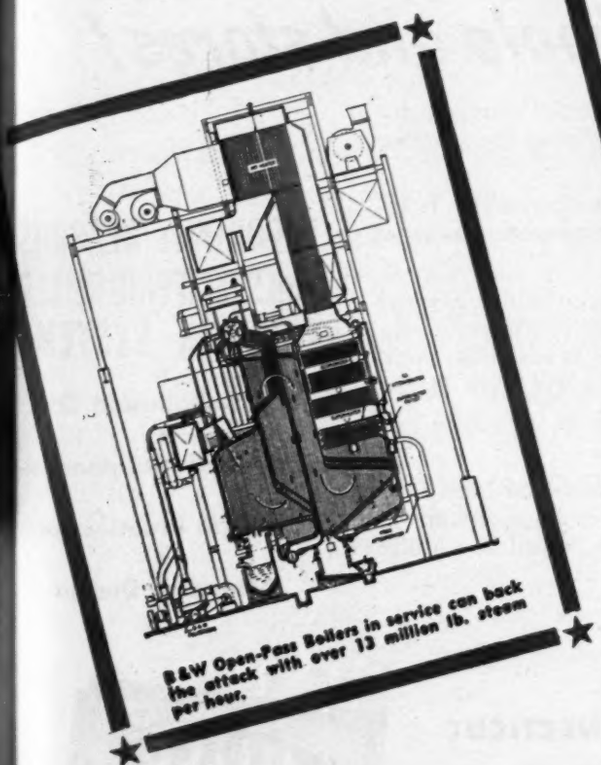
It would be impossible to over-emphasize the importance of power to the almost incredible production of ships, planes, tanks, guns, ammunition, and other war material. In producing steam to supply electrical energy, American power plants are keeping war-plant machines humming at stepped-up speeds never before attained. As J. A. Krug of WPB aptly sums it up, "Power has never been too little or too late."

Working with power plant executives and personnel has been a privilege for Babcock & Wilcox . . . and an opportunity to apply our experience in steam generation to the war-vital needs of expanding and maintaining boiler capacity.

We at B&W know that when the history of this war is written, the electric light and power industries will receive high recognition for a job well done . . . even wider recognition than the special citation already conferred upon them "for distinguished wartime achievement."



B&W Radiant Boilers in service contribute over 15 million lb. steam per hour to the war effort.



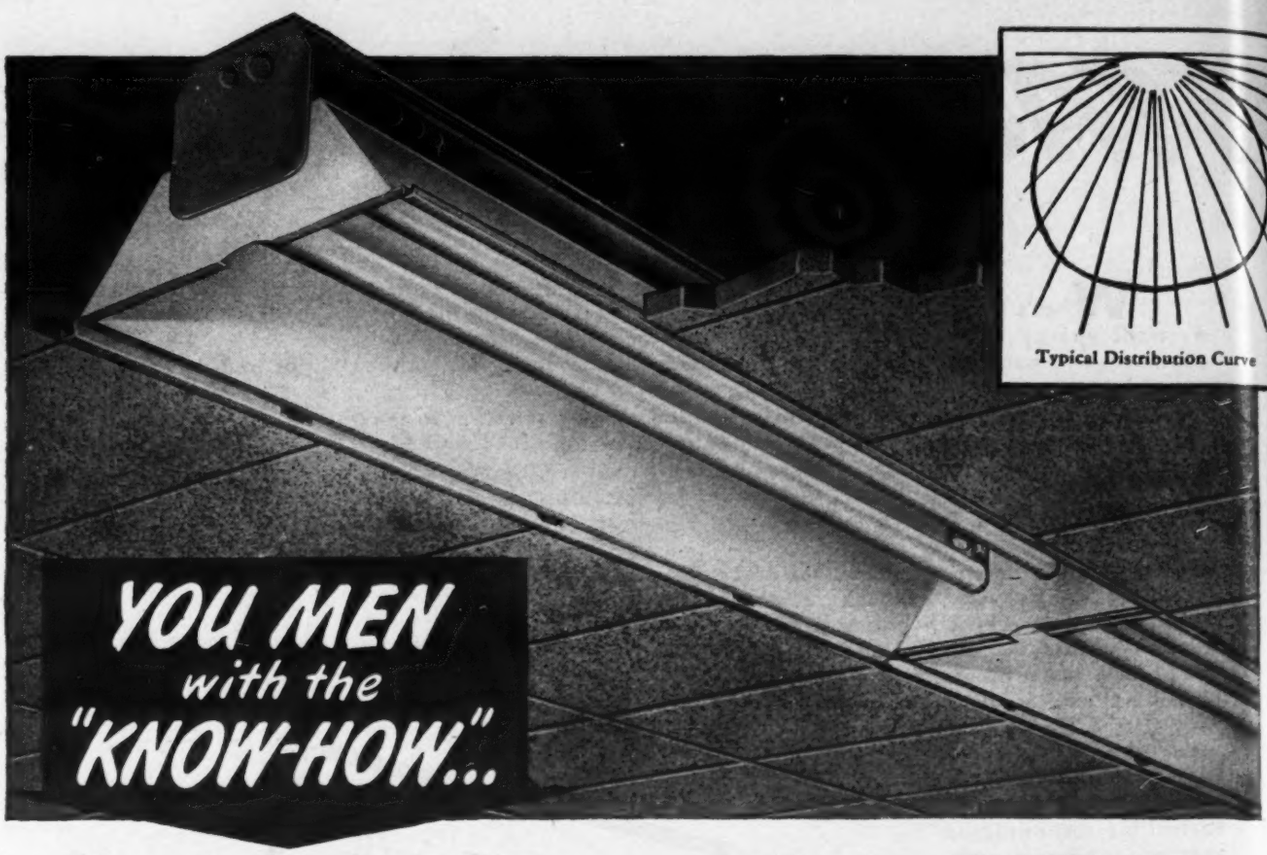
B&W Open-Pass Boilers in service can back the attack with over 13 million lb. steam per hour.

The Babcock & Wilcox Company

85 Liberty Street, New York 6, N. Y.

& WILCOX ★★★★★★★★★★

G-274T



Typical Distribution Curve

Here's lighting you can plan to Do Things with... for offices, schools and stores!

Miller continuous Fluorescent Lighting Systems are the triumph of 100 years of lighting leadership. 100 years of trial and error and success. 100 years of wide experience with all light sources and all fixture types and materials.

Miller systems have solved the worst lighting "bottlenecks" on our production front. They are so versatile and practicable—and attractive—that their possible uses meet most architectural requirements.

The Miller two-light Troffer shown above is an indication of advance*Miller pioneering to broaden still further every lighting benefit offered by the original Miller lighting system. It can be installed (easily and in almost any type ceiling) in individual units, in any combination or grouping of units, or in continuous rows—BY THE MILE!

It is economical to install, economical to service and so flexible in its application that almost any level of illumination can be obtained for a given area.

Miller works not only with fluorescent but also mercury-vapor and incandescent—so Miller Engineers are unbiased in their recommendations. Miller Engineers are in principal cities and it's their job to help you lick your problems. So call in a Miller Engineer for a round-table talk—or call us directly.

It's just that easy to cash in on what 100 years have taught us!

**Shown now only for your advance planning*

IMPORTANT REASONS FOR SPECIFYING MILLER LIGHTING SYSTEMS

- **Low Installation Cost**
- **Simplified Maintenance**
- **Uniform Illumination**
- **Attractive Design**

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
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Domestic Oil Burners
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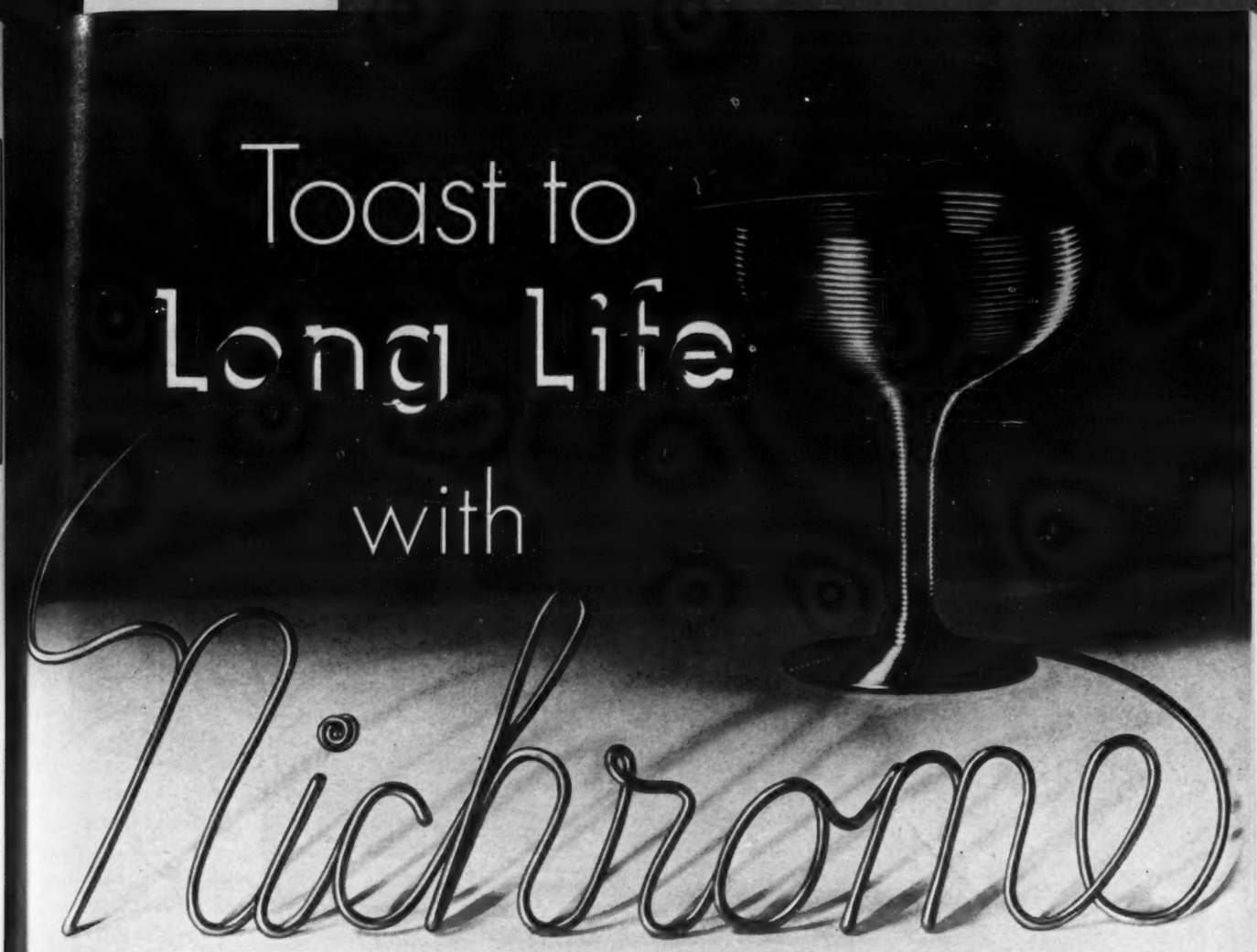
WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844



made Only by Driver-Harris

Electrical resistance and heating elements wound with Nichrome* live a longer life of satisfactory service because of *perfected heat and corrosion resistance properties.*

Indeed — Nichrome* is the universally accepted standard of quality in dependable resistance alloys, for this exclusive Driver-Harris nickel-chromium product enjoys an enviable record with leading manufacturers of electrical equipment throughout the world.

Product of unceasing Driver-Harris research Nichrome* is more than a combination of metals. It is the result of 45 years of specialized knowledge and exclusive D-H methods, formulas and quality controls in the production of the *world's foremost resistance alloy.*

Nichrome*. . . is a toast to longer life and improved performance in your post-war products, so specify it and other D-H resistance alloys when buying resistors and heating elements.

*Trade Mark Reg. U.S. Pat. Off.

D H
SPECIAL PURPOSE ALLOYS SINCE 1890

Driver-Harris
COMPANY

HARRISON, NEW JERSEY

BRANCHES: CHICAGO • DETROIT • CLEVELAND • LOS ANGELES • SAN FRANCISCO • SEATTLE

Vinylite

TRADE-MARK

"Vinylite" Plastic Wire and Cable Insulation

Sets New Standards of Chemical Resistance

In many industrial applications, wire and cable insulation becomes drenched with oils and grease. Below ground, it runs through acid and alkaline soils. Frequently it is exposed to chemical fumes, the oxidizing effects of air, and the photochemical effects of sunlight. To every one of these chemical attacks, VINYLITE plastic insulation is inherently more resistant than are any of the older types of insulation.

In addition VINYLITE plastic insulation offers many other unique advantages. It is highly resistant to abrasion, stays flexible at low temperatures, and has an extraordinarily low rate of moisture absorption. It can be made in a wide range of colors. Thin wall construction, coupled with high dielectric strength, makes it possible to increase the number of circuits in existing conduits. Certain types, depending upon the plasticizer used, are non-flammable or slow-burning.

Electrical wire and cable with VINYLITE plastic insulation is today serving only essential uses. When it becomes generally available, public utility, industrial, and construction fields, marine, automotive and aircraft applications, will have these advantages of greater safety, dependability, and service life. Write Department 28 for Booklet VR. It describes the characteristics of the various VINYLITE resin compounds for wire and cable insulation and shows their specific advantages for a wide variety of applications.

Plastics Division

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

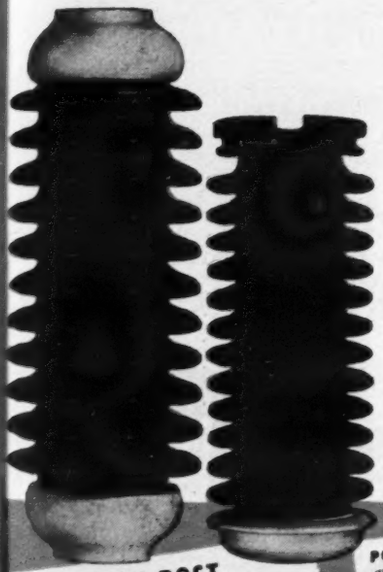
UCC

30 EAST 42ND STREET, NEW YORK 17, N.Y.

Plastics

HOW MANY MAN-HOURS PER-MILE-PER-YEAR FOR MAINTENANCE OF YOUR TRANSMISSION LINES?

In dollars-and-cents, transmission line patrol and maintenance is an important item in normal times. In wartime, man-hours on this job are even more critical. A line on Lapp Line Posts is a year-in-and-year-out economy on either count. Power arcover, stones or bullets, even severe enough to rip a couple of petticoats off, leaves these rugged posts with ample security to do their job. Fog-type design eliminates need for cleaning. Puncture and cracking are unknown in these units. The records on hundreds of installations, in notoriously tough areas, show that it's safe to eliminate most patrol cruises, and that insulators maintenance of all kinds is only a fraction of that on conventional high-voltage insulators.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

Score another war production bull's eye for ***FRINK:***

ENGINE COWLINGS for the cannon-carrying P-39

Pumping powerful armor-piercing shells into enemy tanks and blasting his gun emplacements with explosive cannon fire, the low-flying P-39 is always a welcome sight to our ground forces. On fighting fronts all over the world our troops and the troops of our allies cheer when they see these fast, sleek planes swoop down to clear the way for their advance.

The engine on a P-39 is covered with a cowling, snugly fitted to conform to the shapely streamlined surface of the ship's fuselage. Many of these engine cowlings are made by Frink.

During the 87 years that The Frink Corporation has been specializing in precision engineering and manufacturing, the name Frink has become synonymous with quality and skill in the lighting industry.

A pioneer in Fluorescent illumination as well as in Incandescent lighting, The Frink Corporation developed LINOLITE, the famous "engineered for vision" Fluorescent equipment now giving such profitable and trouble-free service in many of America's foremost factories, stores and banks.

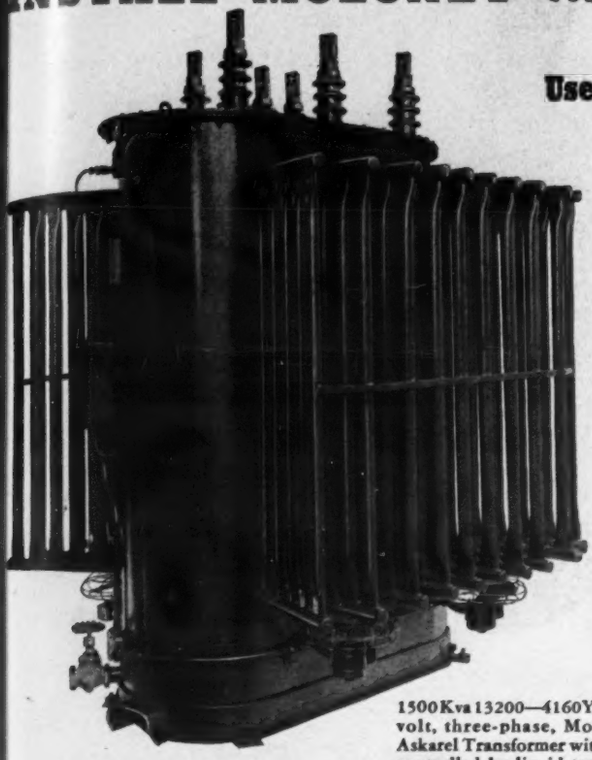
Today Frink is heavily engaged in war production. Tomorrow Frink will resume engineering and manufacturing the high-quality lighting equipment that has gained such an enviable reputation in the industry.

LIGHTING SINCE 1857

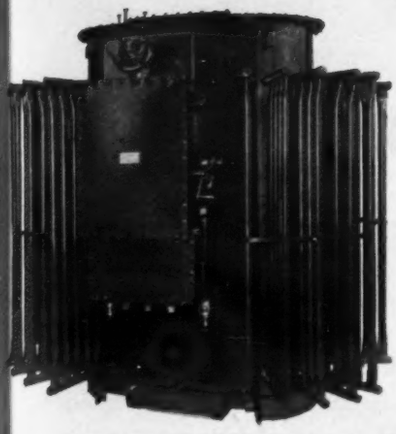
Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation

★ ★ ★ ***All Frink employees invest at least 10% of their earnings in War Bonds.***
WE ARE PROUD OF THAT RECORD. LET'S ALL BUY WAR BONDS! ★ ★ ★

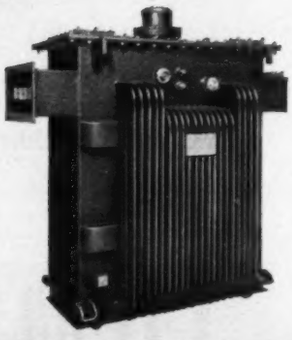
FOR SAFETY AND ECONOMY—
INSTALL MOLONEY ASKAREL TRANSFORMERS



1500 Kva 13200—4160Y/2400 volt, three-phase, Moloney Askarel Transformer with fans controlled by liquid temperature for increasing capacity.



1000 Kva 2400—240 x 480 volt Askarel Transformer with HV selector type disconnect switch and terminal chamber equipped with two sets of cable connections to provide a preferred and emergency feeder to the transformer.



500 Kva 4160—208Y/120 volt, three-phase, sixty cycle, Askarel Load Center Transformer with throats for connection to primary and secondary switchgear.

Used Where Non-inflammable Transformers are Required—Either Indoors or Outdoors

MOLONEY Askarel Transformers are cooled and insulated with Askarel, a non-inflammable liquid. Because of this fact, these transformers are suited to use in applications where oil-cooled transformers would be hazardous to life and property.

Askarel Transformers are ideally adapted to indoor installation in hospital, school, hotel, theatre, office and apartment buildings—in industrial plants, mills and in central stations. They are of weatherproof construction and may be used in outdoor installations. These include in mines, on roofs of buildings, in street and sidewalk vaults for a-c network systems and many other applications where oil-cooled transformers might constitute a hazard.

These transformers effect savings in initial installation costs due to the elimination of expensive fireproof vaults. By locating the transformers at the center of the electrical load, further economies are effected by eliminating long, expensive runs of secondary copper and by providing improved voltage regulation. Moloney Askarel Transformers are available in the same ratings as oil-cooled transformers.

☆ ☆ ☆

Askarel has been approved by the Underwriters' Laboratories for use as an insulating medium and the National Electrical Code permits the installation of Askarel filled transformers indoors without the necessity for providing a fire-proof vault.

MOLONEY ELECTRIC COMPANY
St. Louis, U. S. A.

MOLONEY ASKAREL (NON-INFLAMMABLE LIQUID-COOLED) TRANSFORMERS

Lumarith* insulation... guards against HUMIDITY'S BLACK HAND OF CORROSION

LUMARITH (cellulose acetate) insulation is especially effective in resisting electro-chemical oxidation wherever electrical equipment must operate in a highly humidified atmosphere. A textile mill spinning-room provides an excellent example. Here humidity must be adequate to keep down static electricity, and contactor coils especially have been known to burn out prematurely due to moisture-induced corrosion. The use of Lumarith insulation guards against this trouble.

Lumarith films for moisture-resisting wrappers and layer insulation, and Lumarith dip coats have excellent dielectric and physical strength and are low in moisture absorption. The films are furnished plain or with a special mat finish which is easy to see and prevents slipping of wires—important winding advantages.

"Lumarith for the Electrical Industry" is a booklet worth studying. Send for your copy. Celanese Celluloid Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

*Reg. U. S. Pat. Off.

LUMARITH*

A Celanese Plastic*

r Victory and the World to Come...

Basic Tools for *INDUSTRY*

e above "inkling" of the scope of Blaw-Knox oducts and services must impress any industalist with the fact that Blaw-Knox possesses ills, facilities, engineering experience of an der to make it truly a partner of industry.

r ferrous and non-ferrous industries Blaw-Knox has long produced rolling mill machinery, olls and other basic equipment. Its leadership equally emphatic in fabricated products for ilroads, public utilities, the electronic industry and general industry. Among contractors, Blaw-Knox is synonymous with speed, efficiency and economy. In the process and chemical fields, Blaw-Knox products include all types of equipment as well as engineering and research based upon long experience.

With Blaw-Knox services and products go the *plus* value of an industry-wide background . . . of ability to think beyond the product into its ultimate uses. A discussion of your special problems is invited.

THE ILLUSTRATION presents a partial idea of Blaw-Knox Products and Services.

1 Transmission Towers
2 Radio Towers
3 Standard Buildings
4 Construction Equipment
5 Steel Forms for Concrete Construction
6 Chemical Plant Equipment
7 Rolling Mill Machinery
8 Electronic Equipment (censored)
9 Open Steel Flooring
10 Another censored line of products
11 Complete Process Plant Units
12 Rolls for Rolling Mills
13 Prefabricated Power Piping
14 Special Castings
15 Castings for Locomotive Frames, Crossheads and Wheel Centers
16 Clamshell Buckets

Buy U. S. War Bonds and Stamps

PACEMAKER FOR ERICAN INITIATIVE INGENUITY

BLAW-KNOX COMPANY

2013 FARMERS BANK BLDG., PITTSBURGH, PA.

VIS FOUNDRY & MACHINE DIVISION,
ls and Rolling Mill Machinery

WER PIPING DIVISION, Prefabricated Piping Systems

TIONAL ALLOY STEEL DIVISION,
and Corrosion-Resistant Alloy Castings

PITTSBURGH ROLLS DIVISION,
Rolls for Steel and Non-Ferrous Rolling Mills

BLAW-KNOX DIVISION, Chemical & Process Plants & Equipment, Construction Equipment, Steel Plant Equipment, Radio & Transmission Towers . . . General Industrial Products

COLUMBUS DIVISION, Ordnance Matériel

UNION STEEL CASTINGS DIVISION,
Steel and Alloy Castings

MARTINS FERRY DIVISION,
Bofors Anti-Aircraft Gun Mounts

BLAW-KNOX SPRINKLER DIVISION,
Automatic Sprinklers and Deluge Systems

Four Blaw-Knox Plants have been awarded the Army-Navy "E" for war-production excellence

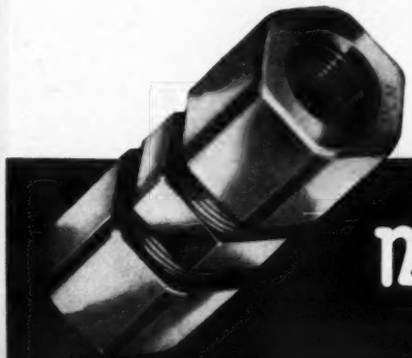
A FEW VICTORY PRODUCTS

AIRCRAFT GUN MOUNTS · GUN SLIDES · LANDING BARGES · POWDER PLANTS · PIPING FOR NAVAL VESSELS · SYNTHETIC RUBBER PLANTS
CAST ARMOR FOR TANKS & NAVAL CONSTRUCTION · CHEMICAL PLANTS

National Electric 4 x 4 is designed for real production plants where speed in electrical maintenance and installation is a factor. Manufactured in standard sized sections with spring latched covers, quick access to any section is assured.

Its four inch square dimension provides ample room for a large number of cables. Knockout clusters for various size conduit extensions are provided every 4 ¾ inches in the back and sides.

Write for a new 4 x 4 Wirewa catalog which will give you complete listing of all fittings as well as installation data.



NATIONAL 4 x 4 WIREWA IS MANUFACTURED BY THE SAME MAKERS OF "GORILLA GRIP" MECHANICAL CONNECTORS

National Electric Products Corporatio
Pittsburgh, Pa.

Electrical World
JULY 8, 1944

Integration of Engineering

In a Number of Cities the local chapters or sections of national engineering societies have banded together to form a local engineering society. Some of them have been in existence a long time and others are springing up from time to time, indicating an unmistakable trend.

There are several reasons for these local all-inclusive engineering groups, some economic and some more inspirational. They are all expressions of a need for unity at the grass roots level.

While the practical considerations, such as sharing the costs of a secretary and of meeting notices, and some times of a meeting place, are all of great importance to local groups working with small fixed budgets, the greatest value comes from something less tangible. Regardless of whether a man is practicing electrical, mechanical, civil, illuminating or any one of the several branches of engineering, he is nevertheless an engineer and these local all-inclusive bodies are a cementing force that can give cohesion to the profession.

Engineers need cohesion partly to protect the profession from unwarranted regulation but more to create a public consciousness of engineering as a great profession. The onward march of industry has created a steadily growing demand for specialization yet despite the fact that there are dozens upon dozens of different kinds of specialized engineers, fundamentally they are all engineers and as such they have an entirely different approach to problems than have members of other professions.

The engineer is different because his education was different, so different, in fact, that many a father has insisted that his son take an engineering course regardless of what kind of occupation the boy might choose to follow. It is this training in the solution of new problems in an orderly way that has made the engineer the creative force of the country.

Regardless of what specialized branch of engineering a man elects to take up he has certain things in common with other engineers, part of which is his training, part of which is his inquisitiveness into the operations of natural forces and part his closeness to the service of the public. These qualities should help to integrate engineers in spite of the growing differentiation.

The need for engineering cohesion has been recognized nationally for some time. An expression of this was the American Engineering Council. However, because this was organized at the top, it never truly reflected the rank and file of engineers. Some time, a national body of engineers that has its roots down in the local communities may be possible, but that cannot happen until the local organizations become more widespread and clamorous for national direction and coordination.

In the meantime, every encouragement should be given to the formation of these local groups. They not only can bring greater cohesion to the profession but they can frequently bring to light the dangers of independent action by national engineering societies. One excellent example of this is the recent excursion by one group into collective bargaining for all engineers.

No profession has greater specialization than medicine, yet it is well integrated. The same is true of law. Through the local societies the profession of engineering may in time perhaps be equally well integrated.

Network Feeders Use Compensated Regulators

Line drop compensation on automatic feeder voltage regulators successfully applied on parallel 13.8-kv. feeders supplying low-voltage a.c. network—No tendency to "hog" load

R. A. BROWN and F. W. MARQUETTE, Columbus & Southern Ohio Electric Co., Columbus, Ohio

DESPITE initial misgivings, parallel 13.8 kv. feeders supplying the Columbus a.c. network have been operating successfully for over a year with line drop compensation used on their automatic feeder voltage regulators. During this time the four feeders have shared the network load in the same manner as before compensation was added and, contrary to expectation, there has been no instance when any feeder attempted to assume more than its share of load.

The initial network in Columbus, completed in 1931, consisted of 30 vaults with 16,500 kva. of transformer capacity supplied by three 13.8-kv. primary feeders. Each feeder was equipped with two single-phase, induction-type regulators connected open-delta and mechanically interlocked. A fourth feeder with a step-type, three-phase delta-connected regulator, was added in 1938. The arrangement is shown.

Majority of the transformers are 300 kva., 3-phase 13.8/120-208 and delta-wye connected. There are a few 150- and 450-kva. transformers. All units, however, have 7½ percent impedance. Bus reactors shown on the diagram are rated 5 percent at 1,000 amp.

The Columbus system has two generating stations. However, due to the interconnected system of 40- and 13.8-kv. transmission lines it is not possible to say definitely that the two substations (No. 2 and No. 13) supplying the network are fed from separate generating stations. Both substations are connected to the two generating plants.

Distance from station No. 2 to the nearest transformer vault is 400 ft. and 7,300 ft. to the most distant. Average length of primary feeders is 2,770 ft. Distance from station No. 13 to the nearest transformer vault is 2,000 ft. and 8,000 ft. to the farthest. Average feeder length is 4,960 ft.

All but 15 percent of the primary cable is 2/0 single conductor. Secondary is 350,000 C. M. single conductor cable with all three conductors pulled in one duct.

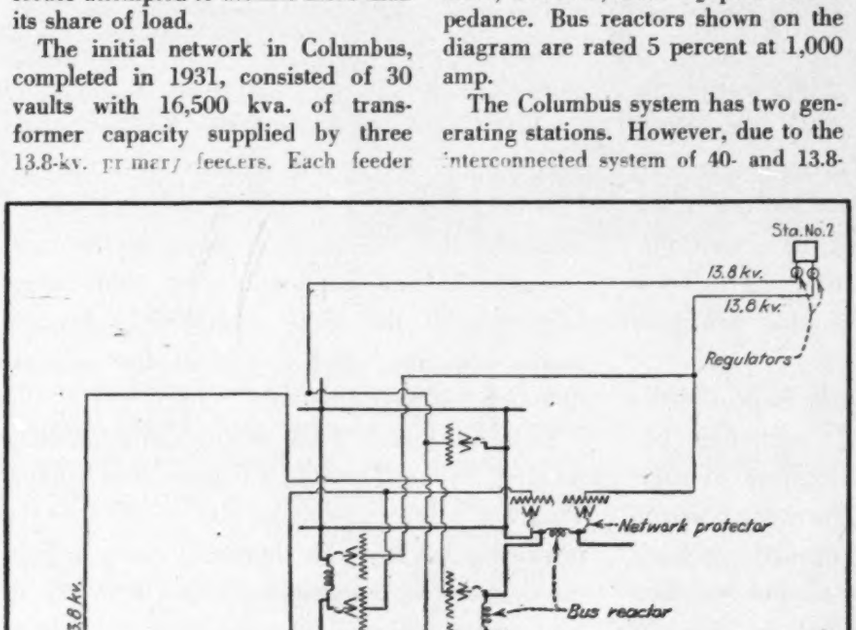
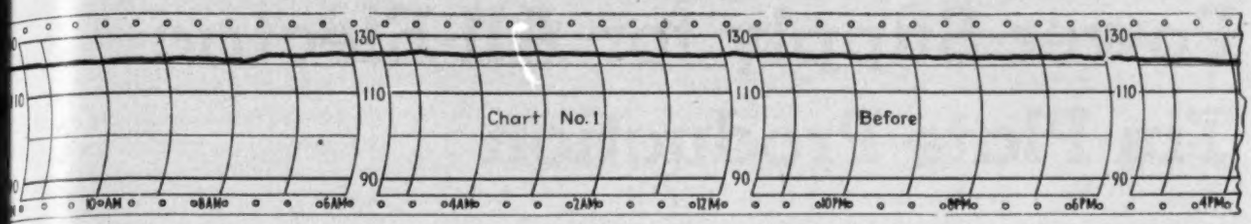


DIAGRAM of 13.8-kv. primary and 120-208-v. secondary connections for underground a.c. network at Columbus, Ohio. Line drop compensation is used on primaries

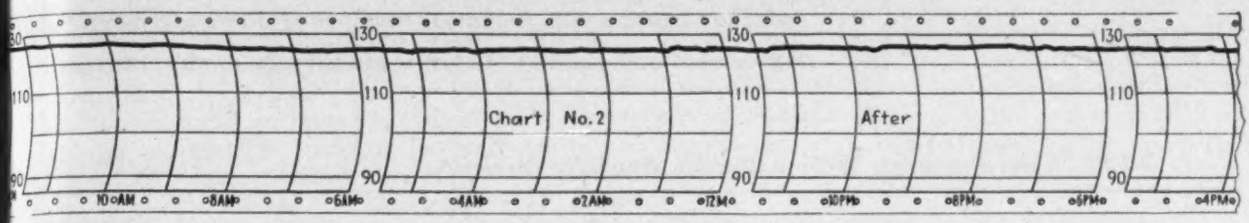
Peak Load Problem

No difficulty was experienced in maintaining satisfactory voltage on all portions of the network with straight voltage regulation i.e., constant bus voltage, as long as load on the network remained relatively light compared with transformer and feeder capacity. As load on the network gradually increased, however, it was no longer possible to furnish satisfactory voltage to customers some distance from the transformer vaults during peak load periods, without having excessive voltage on the network at minimum load period. Excessive voltage was especially severe where customers were supplied directly from the transformer vaults. Chart No. 1 illustrates the condition. peak load voltage was 120 with a rise of 4 volts at minimum load.

Experience has indicated that 120



ETWORK voltage chart before compensating regulators shows 120 volts during peak periods and rise of 4 volts during light load



UBSEQUENT network voltage chart shows slight over-compensation of the feeders after the change

olts could be maintained at the aults during peak load without damge to the customer's equipment. Now he question became "How can 124 olts be maintained at peak load peiods and not have excessive voltage uring minimum load periods?"

This condition *could* be met by inalling additional primary feeders, ransformers, and secondary mains to educe the voltage drop until an almost flat voltage condition could be aintained at the customers' service. ut, even if materials had been obainable the cost of such a solution ould have been excessive. A method as needed that would give the same esults without the additional matei al and could be applied immediately.

Over-compensation Applied

The possibility of using compensaon on the network feeders voltage egulators had been considered but here was some apprehension lest ver-compensation of the feeders ould cause one of them to attempt assume the entire network load, hereby opening the feeder braker. his condition might be cumulative nd as each successive feeder picked the load its breaker would open, ading eventually to an outage on e network system. Unfortunately, information was available in the erature or from other companies on perience with the use of compensaon on similar installations.

Finally, however, voltage condions became so bad that it was deded, despite the hazard, to use comnsation in the network feeders. The itial step requiring lowering the ltage on all four feeders until the secondary bus voltage was approximately 122 volts at minimum load periods. A small amount of compensation was then added at minimum load periods to each feeder regulator and the results closely checked by using recording volt-meters and feeder load checks. No difficulty having been experienced on the initial step, compensation was gradually increased until the results as shown in chart No. 2 were realized. This chart shows a desirable over-compensation.

All the regulators have separate resistance and reactive compensation. Only resistance compensation was used however, with a setting of 11 points on the two feeders from station No. 2 and 13 points on the two feeders from station No. 13.

A year's experience with regulators over-compensated has shown that initial fears were entirely unfounded. Feeders have shared load in the same manner as before compensation. The only refinement contemplated is the installation of relays on the feeders that will sound an alarm or otherwise indicate if any feeder attempts to assume more than its normal share of the load. This will allow remedial measures to be taken before any feeder assumes enough load to open its station breaker.

• • •

Electricity Requirements U. S. Manufacturing and Extracting Industries

INDUSTRY GROUP	MILLIONS OF KILOWATT-HOURS					
	1939	*1940*	*1941*	*1942*	*1943*	*1944*
Manufacturing Industries:						
Chemicals	9,811	12,585	16,254	21,140	29,600	32,636
Nonferrous metals	5,956	7,730	10,439	15,126	23,786	28,560
Iron and steel	12,235	14,753	18,682	20,209	23,435	24,329
Paper	9,394	10,410	11,658	11,736	11,885	11,941
Textile	6,805	7,352	9,074	9,692	9,953	9,977
Food	6,388	6,488	7,263	7,773	8,287	8,386
Transportation equipment	482	771	1,564	4,038	6,735	7,635
Stone, clay, and glass	4,852	5,351	6,574	6,918	6,537	6,437
Petroleum and coal	3,440	3,805	4,303	4,496	5,337	6,296
Machinery, except electrical	1,985	2,544	3,613	4,882	6,012	6,254
Automobiles	2,467	3,035	3,663	3,462	4,534	4,668
Electrical machinery	1,432	1,811	2,511	3,024	3,664	3,895
Rubber	1,584	1,663	2,071	1,779	2,017	2,075
Lumber	1,238	1,382	1,537	1,616	1,663	1,668
Miscellaneous	466	526	672	792	968	1,005
Printing	859	911	978	981	984	989
Furniture	605	688	817	846	898	904
Leather	402	406	489	523	536	531
Apparel	353	373	444	453	451	454
Tobacco	115	125	137	148	151	153
All manufacturing	70,869	82,709	102,743	119,634	147,433	158,793
Extracting Industries:						
Coal mining	3,523	3,981	4,267	4,883	5,328	5,408
Metal mining	2,912	3,331	3,758	4,139	4,309	4,380
Nonmetallic mining	813	915	1,147	1,226	1,271	1,291
Petroleum and natural gas	837	923	915	901	938	938
All extracting	8,085	9,150	10,087	11,149	11,846	12,017
All industries[a]	78,954	91,859	112,830	130,783	159,279	170,810

[a] Excludes government owned and operated establishments.

The table above reports industrial use of electricity in the United States, 1939 through 1944 (estimated), and is based on figures reported to the Federal Power Commission by 21,000 manufacturing, extracting and government establishments. These establishments use over 90 percent of all industrial electricity; but the figures reported herewith have been expanded by the F. P. C. to correspond to Census data.

Source: Federal Power Commission, March 1944

Power Supply for All-Electric Tin Plate Production

High speed tin plate lines use electro-plating and high frequency induction heating with ingenious methods of automatic control of plating current and heating energy responsive to production speed

C. J. DUBY, Chief Engineer, Warren District, Republic Steel Co.

MOST COMPLEX of all electrical installations in the plants of the Republic Steel Corp. is the system of power supply and control of the two electrolytic plating and high-frequency "flow brightener" lines for production of tin plate in the Republic mill at Niles, Ohio. An idea of the complexity is afforded by the facts that in the installation for the two lines over 500 motors and generators are included and that 141 miles of wire and 17 miles of conduit were used.

These lines are located side by side and cover a length of 540 ft. from charging to delivery end. Each includes pay-off reels or uncoilers, deflector rolls, 4-hi pinch roll unit, double crop shear, 48-in.-double-roll electric seam welder, automatic self-centering side guides, 40-ft. deep looping pit, drag unit, electrolytic cleaning tank, wringer rolls, double scrubbers, acid etch tank, automatic strip guide, double scrubbers, 24-cell electrolytic plater unit with drag-out control and chemical treatment, hot rinse tank, induction flow brightener unit, dryer, precision tension unit, chemical dip tank, oil emulsion tank, dryer, lap detector, pinch roll unit, double snip shears, reel chutes, rewind reels, vertical belt wrappers, drag tension roll unit, pinhole detector, automatic flying shear, automatic sheet classifier with electric gager and pinhole detector.

Coils or Cut Lengths

Eight hundred and seventy five (875) feet of strip are required to thread each line. The equipment is designed for handling 15,000-lb. coils with outside diameters up to 62 in. A minimum change to the uncoiler would allow handling of 30,000 lb. coils. The lines are designed for handling strip from 16 to 38 in. wide and from 36 to 22 gage (0.007 to 0.03 in.) in thickness. The equipment is so designed as to permit applying any desired coating to the strip steel and delivering the finished product either in coils or in cut lengths neatly piled, ready for shipment.

CONTACT rolls carry heavy current to strip in plating bath

In the operation of the lines the strip enters the line from one or the other of two uncoilers which are used alternately. The line speed can be varied from 100 f.p.m. to 1,300 f.p.m. As a new coil is required for the line, it is placed on the idle uncoiler, then as the preceding coil is nearly exhausted, the entire line is slowed down to "threading speed" of 100 f.p.m. and the trailing end of the exhausted coil is stopped. A loop in a 40-ft. deep looping pit meanwhile furnishes strip for the plating line. The trailing end of the preceding coil and the entering end of the new coil are quickly welded together on a traveling, interrupted-seam welder and the line is then again brought up to top speed. The plater section does not stop during the welding operation.

The strip is continuously run through tension and drag roll through an electro cleaner tank through a scrubber, through an acid etch or "pickle" unit, through another scrubber then into the plater. The steel moves through a series of twelve plating cells where tin is plated on one side only, then runs up and back in reverse direction through twelve more plating cells mounted above the first set, being plated on the reverse side then the strip once again changes its direction and moves through a solution recovery system, through a hot water rinse tank, through the "flow brightener" unit, through a chemical treatment tank, through an oil emulsion tank and finally onto one of the reels or into a sheet cutting line.

The entire line is synchronized by all the uncoilers, tension units, drag units and reels being operated on variable voltage Ward-Leonard system, and all motors are fully compensated with IR drop boosters. Speed and tension must be controlled accurately and the entire electrical system is designed to meet these requirements.

Power Supply

Power is purchased from the local utility at 23 kv. and is fed into the 23,000/2,300-volt, 6,000-kva., 3-phase 60-cycle self-cooled transformers. Each transformer feeds two outdoor type 1,200-amp. oil circuit breakers, one for the tinning line indoor unit substation, and one for the reflow unit. Bus switching is provided on the 2,300-volt side so both No. 1 and No. 2 lines can be fed from one transformer during an emergency.

One indoor unit substation is provided for each line, and is located

lose as practical to the center of the lectrical load. Each station consists f totally enclosed compartments conaining: the air circuit breaker for he 800 hp. synchronous motor on the ain Ward-Leonard set, the neutral eactor for starting the 800 hp. motor, he reactor-shorting air circuit reaker, the energizing air circuit reaker for the 2,000-kva. 2,300/440olt three phase air cooled transformer. Throat connected to these igh voltage compartments is the ,000-kva. air-cooled transformer, hich in turn is throat connected to he 440-volt distribution compartents containing four circuits with anually operated breakers.

One of the electrical problems was he possibility that the plating power equired might be doubled by the delopment of new plating solutions. ower for the plating rectifiers is upplied from the indoor unit substaion. By forced air cooling, the ratng of the air cooled transformers in he indoor unit substations can be aised from 2,000-kva. to 3,000 if nore plating energy is needed.

Generators or Rectifiers?

One of the most important electrical problems that had to be faced was the question, "Should the plating power be furnished by low voltage generators, or rectifiers?"

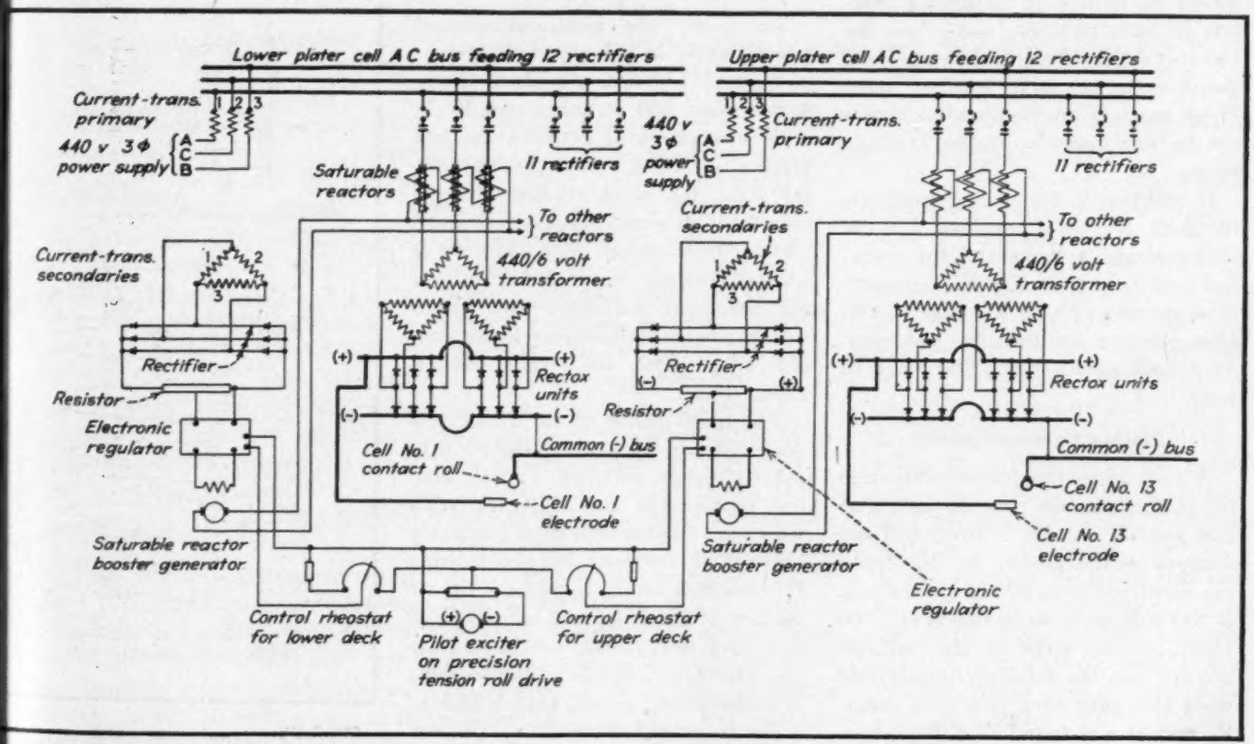
This question was turned over to a committee of electrical superintendents and engineers of the corporation for analysis and recommendation. Very complete data on efficiencies and maintenance costs on existing low-voltage generator installations were carefully studied and compared with similar estimated data on rectifiers. It was found that although overall full load efficiency of the rectifiers could be expected to be 5 to 10 percent lower than generators, the lessened maintenance of the rectifiers could be expected to give an over-all annual saving of approximately $1,700 for the two lines, based on copper-oxide rectifiers.

Careful investigation of initial costs showed that we could purchase rectifiers for approximately the same cost as motor generator sets when the starting equipment was included.

The major saving was found to be installation costs. The rectifiers could be installed right on the operating floor with each one very close to its plating cell. In order to install generators, it would have been necessary to provide a cellar under each plater approximately 15 ft. wide, 12 ft. deep and 120 ft. long. The roof of this cellar would have had to be heavily reinforced to carry the plater. Additional air cleaning equipment and fans would have had to be provided. The low-voltage bus runs to the platers would have been increased substantially in length requiring the purchasing and installing of 55 tons of additional copper bus. This 55 tons of copper that was saved is equal to the amount of copper wire that was required to install all the electrical equipment. This one advantage cut the copper requirements for the entire installation from approximately 134 to 77 tons. Not only was critical material saved, but also labor. It is conservatively estimated that a direct saving on initial costs of $87,700 was realized by installing rectifiers instead of generators.

Can Be Doubled

The copper-oxide rectifier finally chosen is rated 5,000 amp. at 6 volts, reconnectable, if desired, by external bus to 2,500 amp. at 12 volts. The rectifiers were so installed, by leaving space between each pair, that another complete set, doubling the plating power capacity, can easily be installed if it is found necessary. The rectifiers are completely sealed from the mill air, with each unit having its own water-cooled heat exchanger and fan. The tendency for the rectifier cases to condense water on their surfaces due to the high humidity in the proximity of the plater is taken care of by recirculating the cooling water and al-



CIRCUIT for balancing plating voltage against speed of strip going through mill of Republic Steep Corp.

CONTROL station at delivery end of line. Note microphone and speaker for quick communication with other stations

lowing only enough cool makeup water to enter the system to keep the temperature of outgoing water from the rectifiers at approximately 75 deg. F.

The rectifier bank for each plater has a total capacity of 120,000 amp. at 6 volts, or 60,000 amp. at 12 volts, and constitutes the largest single block of low-voltage rectified power in the world.

The plating voltage is controlled by means of individual saturable reactors in each rectifier, and is on the 440-volt supply feeding the step-down transformer in each rectifier unit. These reactors are designed to give a ten to one rectifier output voltage range.

In addition to the plating rectifiers, rectifiers are also provided for the electro-cleaning tanks and the chemical treatment tank. The cleaner rectifiers are two (2) 2,000-amp., 15-volt units per line and the chemical treatment tank unit is rated 600 amp. 18 volts.

Plating Current Control

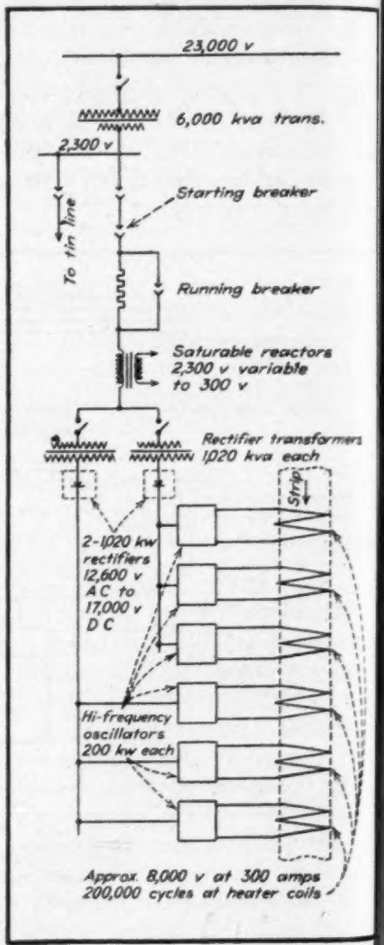
A very important consideration in the plating process was the total current control for the bottom and top sections of the plater. As line speed can be varied from 100 to 1,000 f.p.m. at 230 volts and can be raised to 1,300 f.p.m. at 300 volts on the variable voltage bus, the total plating current must also vary over this wide range. By test, it was found that the incoming line current varied with the outgoing d.c. current so very closely that it was entirely practical to insert a totalizing current transformer in the power line feeding each of the banks of rectifiers. This resultant control current, after it was rectified by a small copper oxide rectifier, is fed into a resistor and the resulting voltage drop is compared with a voltage generated by a pilot generator running at line speed. These two control voltage sources are fed into an electronic regulator that controls the d.c. excitation of the entire group of twenty-four saturable reactors, located in the rectifiers. The line speed voltage is the master reference. As the line is speeded up, the tachometer voltage goes up and the electronic regulator raises the plating voltage, hence the plating current, until the two reference voltages match. This scheme works very well to vary the plating current exactly proportional to line speed. A rheostat on the delivery and desk controls the amount of total plating current delivered to the plater at top speed, and the control previously described automatically varies the actual current at various line speeds. Means are also provided to make the regulator follow a taper bias instead of exactly proportioning plating current to line speed, but to date this feature has not been required.

High Frequency Heating

To house the electrical control panels, variable voltage motor generator sets and booster sets for the lines, a basement 300 ft. long and 19 ft. wide was provided between the two plating lines. For ventilation two 40,000 c.f.m. fans draw air from the outside through electrostatic air cleaners of the "Precipitron" type. The air is blown through the entire length of the basement and discharged either into the main building or to the outside, depending on weather conditions.

The brightening of the tin strip is accomplished by heating the strip to approximately 450 deg. F. and passing it through five inductor coils which are excited with high frequency alternating current, thereby melting the electrolytically deposited tin on surface of the strip, and causing it to flow to a mirror-like, brightened finish. The strip with the molten coating is immediately passed into a tank of water to quench the coating. One advantage of this method of heating is that no electrical or mechanical contact with the strip is required. Also, the control of power input can be varied quickly to follow the changing line speeds.

Power for the high-frequency induction heating is obtained from the mill distribution system at 2,300 volts through air circuit breakers, which provide a starting and interrupting means, to 3-750-kva. saturable core reactors. The purpose of these reactors is to provide a means of controlling the output power of the induction heating equipment to correspond with strip speed by controlling the input voltage to this equipment. A relatively small 38-volt d.c. generator is used to saturate the cores of these reactors. When the reactors are fully saturated the voltage available at their load terminals is very nearly equal to the line potential. When the reactors are not saturated, the voltage may be reduced by the reactors to around 300 volts, depending upon the load. Control between these limits is through the



ENERGY supply to high-frequency "flow brightener"

field of the saturating generator by means of a motor operated rheostat.

The output of the reactors goes through disconnecting switches to two 1,020-kva. plate power transformers. The voltage is here increased by the ratio of 2,300 to 12,600 and fed into two full-wave electronic rectifiers each consisting of twelve half-wave mercury vapor rectifier tubes. The d.c. output potential is approximately 17,000 volts.

200,000 Cycle Energy

This d.c. is fed to six high-frequency electronic generators or oscillators rated at 200 kw. each, which produce alternating current at approximately 200,000 cycles per second. This high-frequency current is applied to the work coils through which the tin plated steel strip is drawn and the strip is heated by eddy currents induced within the strip itself. This equipment is capable of reflowing tin plated strip 30 in. wide at a rate of 1,000 f.p.m.

The required auxiliaries associated with this equipment consist of: (1) a distilled water recirculating system used to cool the high vacuum electronic tubes in the oscillators, the work coils in the flow brightening furnace and the transmission lines to these coils, (2) two heat exchangers to cool the distilled water, (3) two main water circulating pumps and two booster pumps, (4) a 210-kva. filament excitation transformer with an induction regulator for voltage regulation; (5) a saturating M. G. set, (6) the necessary control equipment for water pumps, and (7) protective relays for each of the oscillators and rectifiers.

The over-all electrical efficiency of this type of equipment is approximately 50 percent.

The reflow electrical equipment is housed in another basement 55 ft. wide by 64 ft. long. This basement is also ventilated with air cleaned by a 40,000 c.f.m. capacity Precipitron and forced into the basement by two 20,000 c.f.m. fans.

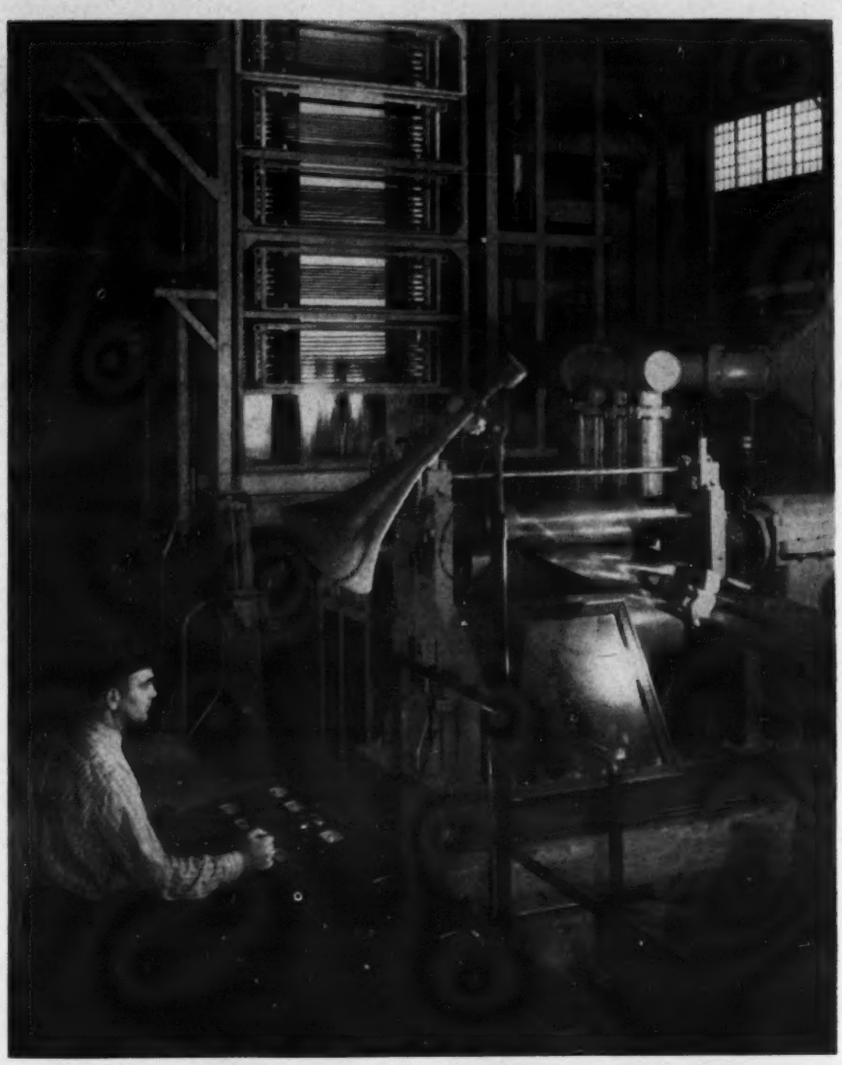
Communication

As each line is approximately 540 ft. long, rapid communication between the various control desks and the electrical basements is an absolute necessity. There are four control desks on each line, one at the entry end, one at the flow brightener unit, one at the delivery end of the plater line and one at the shear line. Each desk has a microphone and speaker. Each level of the plater also is equipped with a microphone and speaker. By depressing the "talk" key, a man at any microphone location is heard through all the speakers except his own. The electrical basements are also equipped with microphones and speakers, and by a transfer system either No. 1 or No. 2 Line's communication system can be connected to the basements.

The plating line is arranged to coil the plated strip on either of two reels, or to bypass the reels and continue on to a conventional shear and classifier line. When the plating line is reeling the strip, the shear and classifier can be run as a separate unit. The shear cuts the strip into tinplate lengths at a line speed of 750 f.p.m. and the strip is automatically inspected for pinholes by an electronic detector. An electromagnetic gager that continuously measures the strip thickness without touching the steel is also incorporated in this line.

Off-gage sheets and those with pinholes are automatically rejected into one pile and the "prime" sheets are run onto another pile. The prime sheets are counted by a high speed photoelectric counter and when 1,120 prime sheets are on the "prime" pile a signal operates to let the operator know he has a package. This pile is then removed and another pile started.

Photoelectric devices play an important part in the successful operation of these lines. Loop controls, automatic side guides, recentering strip guides, pinhole detectors and counters make up a total of twenty-one photoelectric devices in use on each line.



INDUCTION COILS by means of which high frequency energy is applied to the sheet moving through them appear in the upper center of the picture. Note the dull surface of sheet at top of the coils turned to mirror-like shininess at the bottom

Convert Three-Wire Meters On Miniature Assembly Line

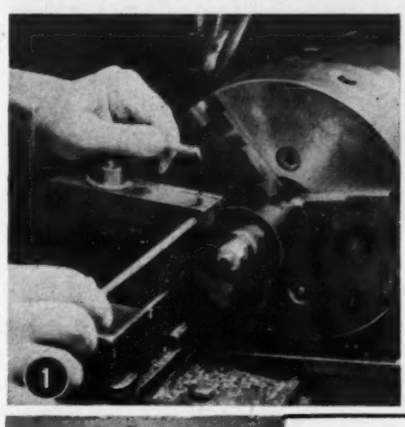
Production line methods applied to conversion of three-wire watthour meters for two-wire operation cut alternation costs to fifty cents per meter—Use available tools and scrap material

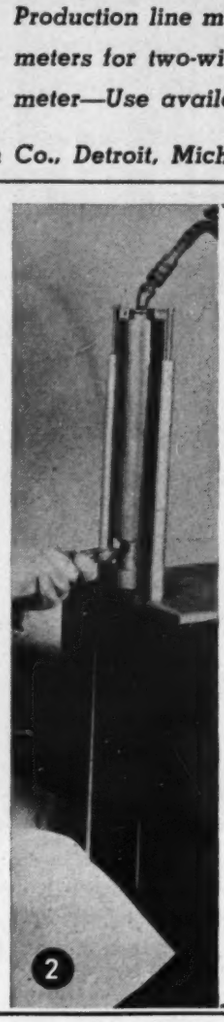
E. L. HOEFLER*, Detroit Edison Co., Detroit, Mich.

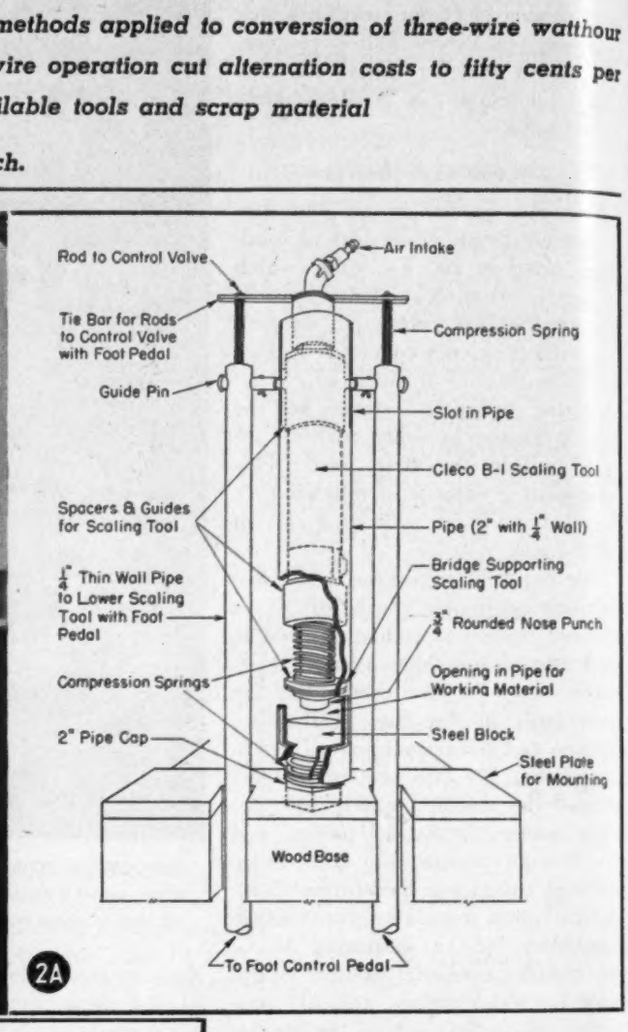
SINCE RESTRICTIONS were first placed on new three-wire watthour meter installations, the Detroit Edison Co.'s meter department has converted a total of 6,500 of its available three-wire, single-phase, 240-volt meters over two-wire, 120-volt operation. The cost, including labor and material, has been 50 cents per meter.

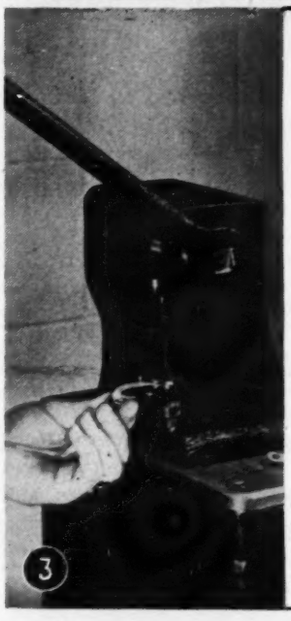
Meters were run through a miniature "conversion line." Here the mechanism was removed from the

* Assistant Foreman, Shop Testing and Repair Division






Rod to Control Valve
Air Intake
Tie Bar for Rods to Control Valve with Foot Pedal
Compression Spring
Guide Pin
Slot in Pipe
Cleco B-I Scaling Tool
Spacers & Guides for Scaling Tool
Pipe (2" with ¼" Wall)
¼" Thin Wall Pipe to Lower Scaling Tool with Foot Pedal
Bridge Supporting Scaling Tool
¾" Rounded Nose Punch
Compression Springs
Opening in Pipe for Working Material
2" Pipe Cap
Steel Block
Steel Plate for Mounting
Wood Base
To Foot Control Pedal



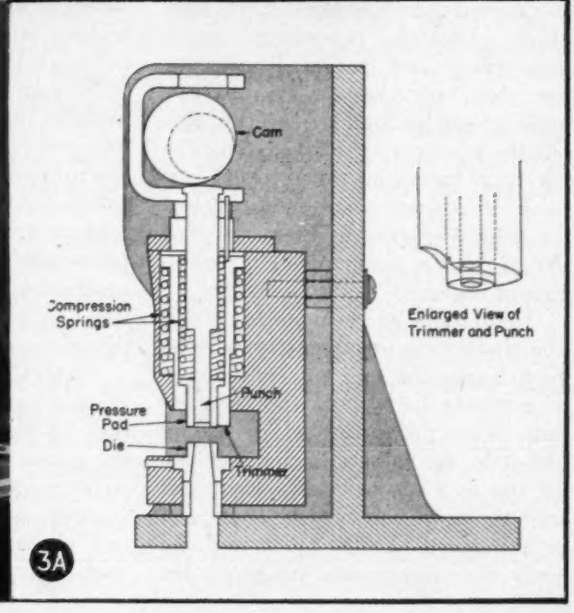


FIG. 1—Cutting Rivets—Rivets that fasten the connector link to current coil leads are cut in large numbers using a 1/16 x 2½ in. key saw in a lathe arbor. An Allen screw locks the No. 6 scrap copper wire in a slotted steel block on the crossfeed

FIG. 2—Connector Links—Ends of the connector link that join current coil elements in series are flattened with a compressed air driven scaling tool mounted in this home-made, pedal-operated jig-frame. Drawing (a) shows detail

FIG. 3—Trimmer and Punch—Flattened ends of connector links are trimmed and punched in a single operation by device sketched in (a)

ase and the two current coils connected in series. One side of the potential coil was disconnected from the current coil and brought out to a separate terminal. Finally the terminal arrangement was made to conform to two-wire meter.

To secure low-cost mass conversion, ingenious use was made of simple tools and salvaged materials. Rivets and connector links are made from scrap copper wire; rivets from No. 6, connector links from No. 8 wire. Accompanying work drawings and photographs show how the tools were used to speed conversion.

1. Copper wire, straightened with chain block is cut in 2 ft. lengths for easy handling.

2. Rivets and connector links are cut to proper length and annealed.

3. Ends of connector links are flattened, trimmed and punched.

4. Connector links are riveted to current coils and coils connected in series.

5. Connections are dipped in solder to insure proper contact.

6. Original meter nameplate is turned over and back stamped with data necessary to identify meter.

The meters can be as easily reconverted to three-wire, 240-volt operation. Simply clip out rivets and connector links, restore current and potential leads to their places, flip over the nameplate and the job is done.

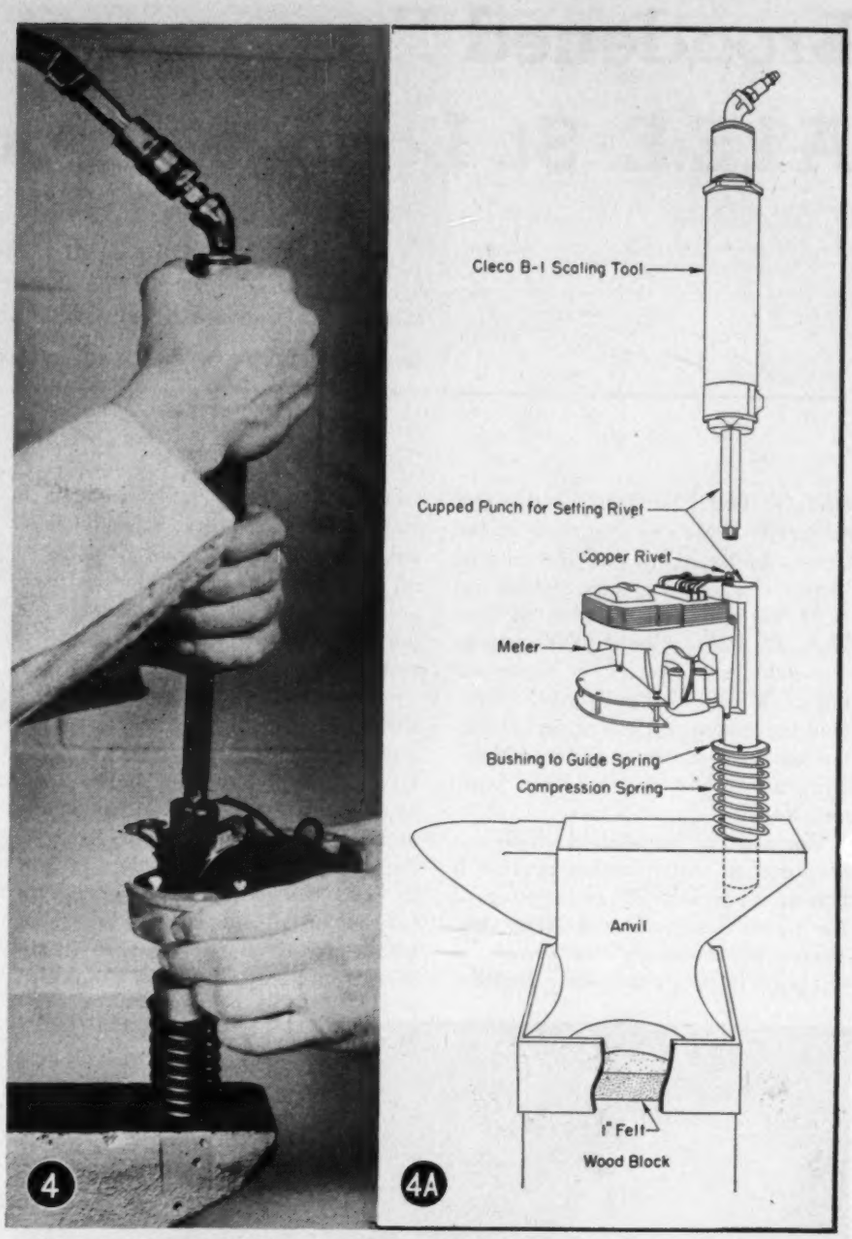
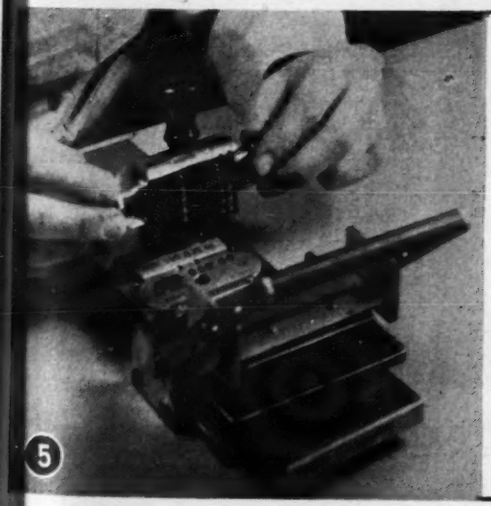


FIG. 4—Setting Rivets—Same air-operated scaling tool used to flatten connector link ends is used as a riveter for connecting coils in series and strap to coil



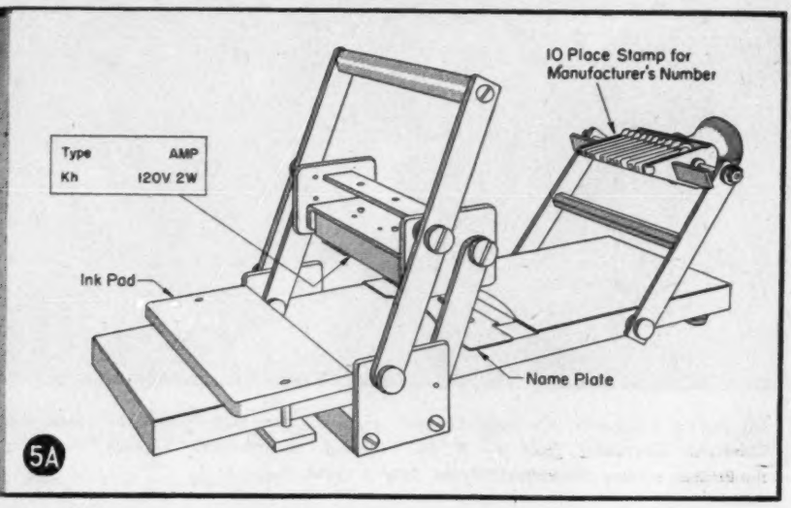


FIG. 5—Stamp New Nameplates—Temporary nameplate for the converted meter is made on the back of the original using this device. Two stamps, one fixed, the other changeable, mark the meter number, factory number, and other identifying data. When the meter is reconverted the nameplate will be turned over

Broadened Program at A.I.E.E. St. Louis Sessions

Electronic power, industrial and marine distribution systems and heating houses electrically join cable movement explorations and generation problems in diversifying extensive program

ONE OF THE MOST formidable and embracive technical programs in the history of the American Institute of Electrical Engineers was carried out in St. Louis during the week of June 26 to 30, 1944. Flavor of the papers was definitely military in numerous instances while others served to extend the lessons of the war period into the era of resumed normalcy. Many uniforms were in evidence from Army and Navy.

One wartime installation which was accorded an entire session because it has so much import for invasion of the power field was the 20,000-kw. electronic frequency converter at Carnegie-Illinois Steel Co. Another event of like significance to industrial and utility engineers was the announcement by Chairman Grotzinger of the industrial power applications committee that the comprehensive report on industrial distribution systems would shortly be available.

Other topics of new appeal on Institute programs were high-frequency industrial heating and electrical heating of homes. From the power field came discussions of gas-filled cables and cable movement, rotor winding deformations and of weather factors in load forcasting. Still other features of broad interest were a resume of the status of the dry-type transformer and a recording of the desire to modify the requirements for impulse tests of transformers.

Over 1,200 members and guests were in attendance. Next year's sessions are planned for Detroit.

Dr. Irving Langmuir, General Electric, receives Faraday Medal of Institution of Electrical Engineers from A. P. M. Fleming, Metropolitan Vickers, representing the British society *(Electrical World,* **July 1, 1944, Page 5)**

Power Generation

The Summation of Load Curves. R. F. Hamilton (War Production Board, Washington, D. C.). Sequel to author's 1941 paper, extends analysis of peak coincidences, load factor, demand factor for composit loads.

Prevention of Rotor Winding Deformation on Turbogenerators. John G. Noest (Consolidated Edison). Preheating to predetermined winding temperature supersedes sudden heating of centrifugally stressed conductors and reduces stresses which otherwise deform rotor conductors; 84 percent rated current at 300 r.p.m.

The effect of Weather on the System Load. H. A. Dryar (Philadelphia Electric).

Conditions Controlling the Economic Selection of Prime Movers. B. G. A. Skrotzki (Consolidated Edison). Analyzes magnitudes of evaluation constants and sets down recommended procedure for determining value of justifiable investment factor for addition of a prime mover.

Recent revision of the proposed series of standard turbogenerators was announced by A.I.E.E. Chairman M. S. Oldacre as comprising six turbines of 12,500, 16,500, 22,000, 33,000, 44,000 and 66,000 kw. instead of the former five. These will be both nameplate and maximum capabilities. With them will be offered generators with corresponding maximum capabilities (at 15 psi. hydrogen) of 12,500, 16,500, 23,500, 35,300, 47,000 and 70,600 kva.; these odd values may be rounded off later. The units are planned to have more kilovar capacity and as good stability as present patterns. There was comment by President Funk that he favored the maximum capability rating, letting each operating group fix their own operating margins to correspond.

H. R. Searing, Consolidated Edison; Dr. A. H. Kehoe, recipient of Lamme Medal of AIEE and N E. Funk, AIEE president *(Electrical World,* July 1, 1944, Page 5)

Rotor winding deformation registered as a serious problem, five machines of three manufacturers and totaling 670,000 kva. having been involved on one company, one machine twice at a repair cost of $100,000 each time. In comment, E. F. Dissmeyer mentioned that the preheating remedy advanced by Noest was comparatively easy to apply on baseload machines, but not so easy to administer on others subjected to varying load cycles. Reduction of the centrifugal and thermal influences to the point where the conductor materials would be designed to function within their elastic limits would be a welcome adjunct of the new standard designs, he said, emphasizing a lower rotor temperature.

E. E. George of the Southwest Power Pool essentially confirmed Dryar's reported experience, stating that cloudiness makes a 10 percent difference and adding the item of warm circulating water as something to consider for weighting along with Dryars' weighting of wind, clouds and temperature. U. Davis said he had been trying to outguess Chicago weather for 40 years and succeeded in estimating loads within 2 percent without employing the refinement of Dryar's weighting.

Studies like those of the Skrotzki paper have to be made two or three years in advance of commitments on prime movers and have, therefore, to anticipate such variables as resort to interconnection supplies, topping and sale of exhaust steam; the tendency has been to install somewhat larger sizes than the rigid analysis dictates. T. G. LeClair (Chicago) cited some of the long-range errors of the transportation industry to support his contention that good business judgment must accompany formal analysis in buying turbogenerators.

Power Transmission

Measurement of Lightning Currents in Direct Strokes. G. D. McCann (Westinghouse). Five-year accumulation of 46 direct strokes, correlated with others, shows half to be multiple, 96 percent starting with negative flow from cloud; 86 percent entirely negative; 55 percent involve 10 coulombs or less; 90 percent have total duration between 0.005 and 0.5 seconds.

Transmission-line Electrical Loadings. S. B. Crary (General Electric). Analyzes potentialities for heavier loading of lines by realizing on reliability, stability and optimum controlled kvar. supply from generators, condensers or series capacitors. Series capacitor effective for loadings above 750 kw.-miles divided by kv. squared.

Ring Buses for Generating and Transmission Stations. E. L. Michelson and **J. P. Gallassini** (Commonwealth Edison). Practical philosophy of the 25-year evolution of the Chicago system along with the operating experience which prompted the advance.

Capacitor Installation at Newport News. V. R. Parrack (Virginia Public Service) and **E. L. Harder** (Westinghouse). War load requirements for kilovars led to choice of capacitors of appropriate voltages rather than a synchronous condenser. Details of comparison, tests, inrush currents, parallel switching, wave shape. No bad effects from cascading.

Capacitors, Condensers and System Stability. J. W. Butler, T. W. Schroeder and **W. Ridgway** (all General Electric).

A Method of Approach to the Consideration of Power Distribution System Costs. O. B. Falls, Jr. (General Electric). Includes subtransmission and substations to obtain overall optimum choice of system. Numerous charts of comparative costs vs. load density.

Sentiment in favor of employment of larger conductors for ties arose in the Crary paper and the discussion

Registration desk on opening day

C. A. Powel, new president; C. E. Stephens, Westinghouse; N. E. Funk, retiring president; H. C. Forbes, Consolidated Edison

of it. H. P. St. Clair sent in comment that the importance of 1²X had hardly been recognized, being so often overshadowed by line charging current. He ventured that many undoubtedly wished they had installed larger conductors to reduce losses and facilitate the kilovar transfers. Every bottleneck in the Southwest Power Pool had been traced to conditions where conductors were small, said E. E. George. St. Clair also doubted whether it would prove justifiable to load many lines, say of 100 miles length, above five times the squared kilovolts.

While H.A.P. Langstaff (West Penn) was asking whether the manufacturers could not make lighting arrestors that would not project shrapnel (like a fragmentation bomb) to 300 ft., E. Beck (Westinghouse) was saying in comment on the McCann paper that no economically feasible arrester is likely to survive a full direct stroke; other paths are what account for the good performance of arresters. Much of the argument along other lines pertained to the question whether discharge current died entirely or merely went to small values between multiple strokes. K. B. McEachron (General Electric) finds evidence both ways and frankly said he did not know how low the bridging current does go. His associate, J. H. Hagenguth, felt that the departures between the two studies could easily be due to instrumental differences.

B. M. Jones (Duquesne Light) asked why the Chicago ring bus scheme carried no protection for the bus sections and got the answer that it was considered a unit with the corresponding transformer in the protection pattern.

Real economy in many instances resides in the small substations, said Jones in his comment on the Falls paper. He added, however, that hold-up prices for substation sites could readily over-ride more legitimate economic factors in influencing the decisions.

In answer to queries, also by Jones, Harder said that the Newport News capacitors were switched manually several times a day, required no special fuses, created no "pumping" and offered no instances of breaker distress.

Chicago's study of capacitors, said E. L. Nicholson, had simmered down to a matter of how much kva. could be added without injecting switching complexities or without incurring generator instability because of high power factor.

Electronic Frequency Converters

History and Development of the Electronic Power Converter. E. F. W. Alexanderson and **E. L. Phillipi** (both General Electric). Acceptance and circumvention of inevitable electronic defects (arc-back and loss of grid control) led to development. D.C. transformation also explored.

The Electronic Converter for Exchange of Power. F. W. Cramer (Carnegie-Illinois Steel) and **L. W. Morton** and **A. G. Darling** (both General Electric). Discusses the functional appropriateness of the 20,000 kw. 25/60 cycle converter; **cites ease and simplicity of control, low contributions to faults, light weight, high efficiency and ability to transfer power through d.c. link regardless of departure in frequency ratio and at preselected direction and amount.**

Design of the Electronic Frequency Changer. C. H. Willis (Princeton) and **R. W. Kuenning, E. F. Christenson** and **B. D. Bedford** (all General Electric).

Switchgear and Control for an Electronic Power Converter. W. N. Gittings and **A. W. Bateman** (both General Electric). Describes and discusses functionally the protective equipment for the two 10,000 kw. converters.

Pentode Ignitrons for Electronic Power Converters. H. C. Steiner, J. L. Zehner and **H. E. Zuver** (all General Electric). Functions and performance compared with thyratron gas-filled tube with thermionic cathode and three grids for control (ignition and arcback).

New freedom of action in system choice and versatility of application of non-rotating power equipment was definitely presaged by the well-correlated group of papers and discussions of the electronic frequency converter (two 10,000-kw. units) which tie the 60- and 25-cycle systems of Carnegie-Illinois Steel with one another and the Duquesne Light 60-cycle system. It was expounded as offering reliability and control of power flow and interchange as well as hastening the day when d.c. transmission and step-down of d.c. voltages can be successful, if wanted.

F. W. Cramer of the steel company said the installation cost more per se than comparable rotating equipment but, over-all, more than made up the difference because of lesser foundation, space and crane values. All 24 rectifier-inverters and accessories weigh only 135,000 lbs. and could be installed on a 150-lb. floor. Savings in losses alone are worth over a half million dollars a year. Tubes can be changed in less than two hours, if necessary. It is still too early to know what the long-term comparative costs are going to be, said Cramer. The installation was cited by H. E. Kent (EEI) and B. M. Jones (Duquesne Light) as being wholly tolerable as to inductive interference, the latter also being content with the flicker propensities.

Jones envisions a use of similar facilities to suppress or control swings between interconnected systems. S. B. Crary (General Electric) believed

that the need for such non-synchronous ties might prove to be limited to situations where confinement of fluctuations to one participant would be dictated.

This General Electric development, Dr. Willis pointed out, exemplifies the sealed-tank philosophy whereas another Carnegie-Illinois installation at Gary exemplifies the pumped-vacuum school of Allis-Chalmers. W. E. Gutzwiller, in describing briefly the 13,000-kw. installation at Gary, promised a full treatment in a subsequent session. He mentioned numerous European counterparts and felt that both American developments signify that electronic frequency conversion, as well as power conversion, has passed the laboratory stage. J. B. Cox (Westinghouse), however, doubted this and said that the installation was much more complicated in control and protection than mere rectification. He hoped no adverse experience would ensue to check the progress and acceptance of electronic power equipment.

C. R. Horrell, Sangamo Electric; R. E. Anderson, Delta-Star; M. R. Gowing, Ohio Brass; C. A. Loveless, Sangamo Electric; C. H. Willis, Princeton University

Industrial Distribution

Extending the Use of Shunt Capacitors by Means of Automatic Switching. W. H. Cuttino (Westinghouse). Switching relieves objectionable leading kilovars at light load while retaining their benefits up to full load. Describes variety of controls.

Automatic Control and Switching Equipment for Capacitor Banks and its Application. T. W. Schroeder and W. C. Bloomquist (both General Electric). Discusses functional operations for control to achieve desired economies or performance; schematic details of 3-step and single-step kilovar applications.

Extensive and favorable comment marked presentation of the report on electric power distribution for industrial plants by the Committee on Industrial Power Application. The report, presented by John Grotzinger (Goodyear Tire & Rubber Co.) is intended as a manual on industrial electrical system design. It covers a wide range of subjects ranging from methods and procedure of estimating load for a new plant to the selection of fuses and breakers and the calculation of fault currents. An appropriation has already been authorized by the AIEE for publication and sale of 10,000 copies of this report through institute channels to electrical engineers in industry this fall.

A. M. MacCutcheon, past president of AIEE, lauded the report as the type of work that would build institute industrial membership and activity. The institute has always been short of industrial operating men, he said, because it has not presented the type of paper that these men are interested in.

W. C. Bloomquist (G.E.) felt that Cuttino in his paper on capacitor switching should have mentioned power factor control, even though there are application limitations. Kilovar and current control of capacitor switching operations are often the best, Bloomquist believed. Multi-step current control tends to complexity, he asserted. B. M. Jones and C. N. Clark (Duquesne Light Co.) in a joint discussion of this paper reported use of the author's method of calculating voltage rise for a number of years to save time and that its accuracy was adequate. They felt that while there are applications for kilovar and current control of capacitor switching that voltage control will find widest application. In closing Cuttino acknowledged that power factor control can't be used widely. The kilovar method is simpler and avoids hunting, he said. If current control can't be used, kilovar is good, he asserted.

The Schroeder-Bloomquist paper drew from V. E. Hill (Duquesne Light Co.) details of 30 installations of permanently connected capacitors on his 4-kv. system for voltage improvement. The installations were not made to improve reactive supply or for *control* of voltage. Voltage correction was not attempted for lack of a light compact pole-mounted control. Such a device is now in process of development on the system to fill the need, however, Hill sadi. R. E. Marbury (Westinghouse) cautioned that repetitive operation of relays may impose a type of service on capacitor control breakers for which they are not suited. Schroeder replied that tests on current inrush showed the high order of the frequency of inrush currents kept these currents, although large, from having a serious effect on breaker contacts.

Industrial Control

The Degree of Short-circuit Protection Afforded Small Low-voltage A.C. and D.C. Starters by Means of Fuses and Circuit Breakers. B. W. Jones (General Electric). Supplements and clarifies intent of author's 1942 paper to conclude that fuses are the only satisfactory available means to fully protect the starters. Circuit breakers introduce much more I²t.

Insulation Temperature Standards for Industrial Control Coils. B. W. Erikson (General Electric). In view of the good experience with the 85 C. and 100 C. rises and the potentialities of new synthetics the author recommends 100 C. rise and 120 C. for 600 volts rating or less.

Industrial Control: Shunted-armature Connection for a D.C. Shunt Motor. G. F. Leland and L. T. Rader (both General Electric). Good speed regulation at low initial cost. Per unit values charted for use with or without supplementary field control.

Modern Cargo Winch Control for Use on Victory Ships. F. H. Holt (General Electric). Describe burtoning rigs, each winch capable of handling 1½-tons at 290 f.p.m. and 400 f.p.m. with empty hook.

B. M. Jones, Duquesne Light; Fred Campbell, United Light & Power Service; E. T. Williamson and E. F. Miller, Iowa-Illinois Gas & Electric; C. M. Lytle, Kansas City Power & Light

B. W. Jones' clarification of his earlier paper should eliminate the misunderstanding that NEC fuses were recommended for interrupting short circuit currents up to 100,000 amp., G. H. Garcelon (Westinghouse) stated in discussion. The controversy has resulted in tests indicating that NEC fuse is not good for much more than its Underwriters' rating of 10,000 amp., he said. Garcelon still disagreed however, with the paper's recommendation. He saw no assurance that faults would always develop where the impedance of fuse, starter and overload relay were in series. Garcelon also doubted that it was good practice to apply standard NEC fuses on any circuit having a greater available current capacity than provided for in the Underwriters' specifications.

B. W. Erikson's recommendations for increasing the allowable temperature rise of industrial control coils met with qualified approval from discussers. G. H. Garcelon (Westinghouse) felt that standardization work on this matter was desirable and that a particular attempt should be made to do away with the existing variety of temperature limits. P. L. Alger (General Electric) saw two courses open: To raise the present limits with the result that anyone can pick his own temperature limit under that ceiling; the more desirable alternative, he felt, was to allow the use of different temperature rise limits for the same material for different applications. There was a need, he believed, for establishing a test code committee to make failure tests on new synthetic materials and establish temperature limits by proof tests. Other discussers felt that changes in contactor coil temperature limits should not be embarked on too quickly as such coils are the contactor element to which the user looks for reliability and life.

Commenting on cargo-ship winch control D. C. Gray (American Hoist & Derrick) made several notable comments. He questioned whether with the wide speed range of cargo winches it was practical to match points on separate winch controls for successful Burtoning. While agreeing that rapid acceleration and deceleration of loads is desirable, he cautioned that it put extreme strain on rigging. Gray offered the suggestion that minimum lowering speeds of 15 ft. per minute could well and safely be raised to 40 ft. per minute.

Also he felt that winch control resistors should be designed to be mishandled since that will be the operating condition.

Transformers

Progress in Impulse Testing of Transformers. J. H. Hagenguth (General Electric). New method using two cathode-ray oscillographs (voltage and neutral current) detects failures not disclosed by ASA test. Has found fault in one turn among 1,350. Recommends modification of ASA C-57.2.

High-voltage Compressed-gas Power Transformers. H. M. Hobart. Pressures up to 40 atmospheres are shown to afford opportunity for up to 75 percent reduction in size, particularly for transmission at 600 to 1,200 cycles.

The Design and Operating Characteristics of Modern Dry-type, Air-cooled Transformers. W. W. Satterlee (Westinghouse). Class B insulation components permit higher than 130 C. Structural details discussed. Moisture not a limiting factor in performance. Seven years' experience.

Hot-spot Temperatures in Dry-type Transformer Windings. H. C. Stewart and **L. C. Whitman** (both General Electric). Shows need for modification of conventional hot-spot allowances to meet the inherently greater rises than for oil-cooled units. Ratio of two increases with coil height and for forced draft.

Issue in the impulse part of the program was largely on the retention or omission from the standards of the requirement of 60-cycle excitation during the full-wave impulse test. Hagenguth had advocated omission and was generally supported by discussers representing Allis-Chalmers, Pennsylvania Transformer and Moloney as well as E. R. Whitehead (Duquesne Light) and R. E. Pierce (Ebasco). P. L. Bellaschi presented the Westinghouse philosophy and experience, expressing preference for energization but not to the exclusion of other indications of impulse breakdown than the evidence afforded by power-follow. He added that the presence of a surge generator right out in an assembly aisle could hardly help having a salutary effect on workmanship.

There was no adverse comment on Hunt's informal paper (ELECTRICAL WORLD, June 24, 1944) in which he urged the respectable savings in copper that would accompany use of one-amp. secondaries for current transformers.

That it is far more important to sustain the varnish film on dry-type coils than on oil-immersed coils was the comment of V. M. Montsinger (General Electric) on the dry-type transformer temperatures because the air has only a fraction of the oil's dielectric strength. Also moisture absorption during idling periods may lead to trouble. Good dielectric strength must be maintained from turn-to-turn and from coil to coil throughout the life of a transformer, particularly if subjected to higher temperatures.

Power Cables

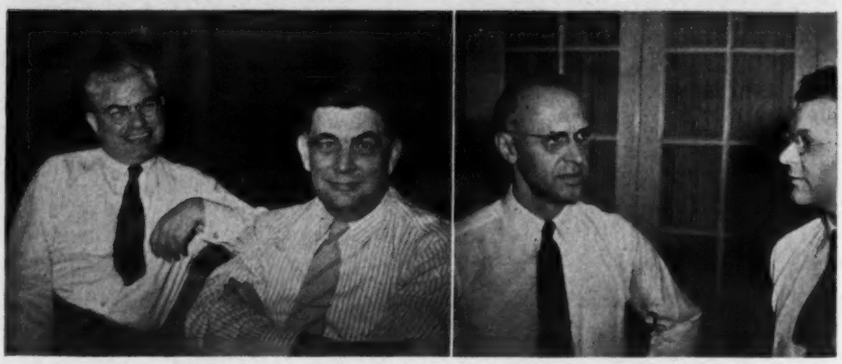
Impulse Strength of Insulated Power Cable Circuits. Herman Halperin (Commonwealth Edison) and **G. B. Shanklin** (General Electric). Gives table of recommended withstand voltages for cables based on conclusion that 1,200 volts per mil is appropriate for well-impregnated solid, oil-filled, oilostatic and compression cables with either polarity. Treats also joints and cambric and rubber cables.

Cyclic Movement of Cable—Its Causes and Effects on Cable Life Sheath. C. S. Schifreen (Philadelphia Electric). Results of 350 tests of snaked cable movement at duct-mouth show that unsatisfactory PILC performance can result from daily operation within AEIC limits. Movement divides unequally. High lead temperature shortens cable life.

An Investigation of the Relationship between Temperature and Movement of Cables in Ducts. C. T. Nicholson and **T. J. Brosnan** (both Buffalo Niagara Electric). Theory, substantiated by controlled tests over 5 months on 8600 feet, advanced on basis of differential expansion of lead and copper.

Gas-filled Cable Research and Experience. G. B. Shanklin (General Electric). In 5 years the twenty installations (15-120 kv.) have had no service failures and offered no signs of insulation deterioration. Advocates average stress basis of decision; questions need for resort to extra thin paper; recommends about 100 Saybolt viscosity at 100 C.

Operation of Low-presure Gas-filled Cable. C. T. Hatcher (Consolidated Edison). Reports on 138,075 feet of 15 and 27 kv. Solid-wall tube preferred for 3-conductor. Details of terminal evolution. No electrical service failures. Breaks remedied before moisture enters. No migration difficulties.



C. H. Leatham, Monongahela West Penn; E. A. Armstrong, Public Service of Northern Illinois; W. F. Wetmore, Detroit Edison; Myron Zucker, Mackworth G. Rees, Inc.

Very little, if any, relation exists between gradient and cable movement in the opinion of H. W. Clark (Potomac Electric Power). He and T. H. Haines (Boston) and H. Halperin (Chicago) all advocated ample offsets in manholes as a good corrective for sheath troubles due to cable movement. Halperin felt that the lengths above which movements cease to increase proportional to length would be nearer to 400 ft. than the 300 ft. implied in the Schifreen paper. M. D. Hooven (Newark) mentioned the nodal characteristics of snaking, reporting tests on cable in open channels and simulated ducts; restraint of end movement resulted in nodes that halved from 16 to 8 and ultimately 4 ft. at critical transition temperatures. There was a tendency to snap into the next shorter wave length if disturbed at those temperatures.

There was general agreement that gas-filled cable ushers a new era in cable promise.

Switchgear

Protection of Large D.C. Machines by Means of High-speed Circuit Breakers. J. Elmer Housley (Aluminum Company of America) and **Otto Jensen** (I-T-E). Design details of a 7,500-amp. FB breaker applied to modernized station with large number of 2,500-kw. 60-cycle rotaries.

A Pneumatic Mechanism for Outdoor Oil Circuit Breakers. L. J. Linde and **E. B. Rietz** (both General Electric). Describes pneumatically trip-free mechanism for high speed operation without synchronized mechanical motions.

Improved Selective Tripping of Low-voltage Air Circuit Breakers. C. F. West (Westinghouse). When short-time current ratings are available for low voltage air breakers, the tripping devices on main and group breakers can be set so as to derive the economies of cascading and better selective isolation of faults.

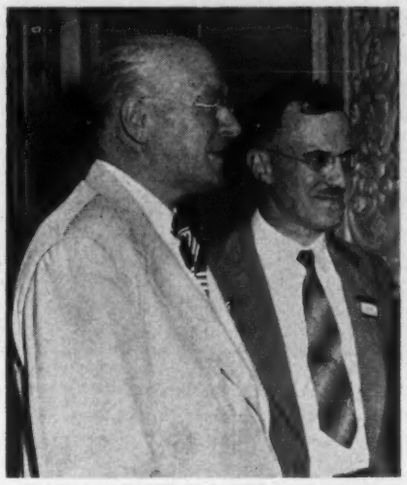
Fusing Practices on Distribution Systems, II. John S. Parsons and **J. M. Wallace** (both Westinghouse). Supplements earlier 5 kv. paper in 5-15 kv. range; percentages found: fuse to protect system from transformer, 86; prefer open drop-out type, 54; repeating fuse cutouts, 9; fusing ratios: for 2 to 3, 41; for 5, 12 and for 7, 10, others scattered up to 15 ratio. Finds trend toward higher fusing.

Fault Protection on Shipboard A.C. Power Distribution Systems. H. G. Rickover and **P. N. Ross** (Bureau of Ships, U.S.N.). Fire hazard demands quick clearing. High service continuity demands isolation. Favored protection is direct-acting inverse time delay trip on air breaker.

C. W. Mier, Southwestern Bell and W. R. Smith, Public Service Electric & Gas

Captain Rickover (U.S.N.) explained in a forceful extemporaneous presentation that naval conditions were not recognized as requiring different and better protective equipment until the "commercial men were shouldered aside" and the manufacturers' engineers reached to devise compact, reliable and coordinate gear which, now, will be available for use ashore. Bus faults dominate, kilowatts have gone up to four and eight times and 100,000-amp. shorts are not uncommon. He said there was "no more buggered situation in the whole electrical set-up than fuses."

A trend toward undue complication of industrial systems was sensed by L. W. Clark (Detroit Edison) and he felt the air breakers could help to



R. H. Barclay, J. G. White Engineering; G. Steeb, Buffalo Niagara & Eastern Power

check this trend and retain simpler patterns. One of the complex systems in his territory found too many breakers and fuses trying to clear a fault.

R. C. Dickinson (Westinghouse) asked Jensen if the need for his large fast d.c. breaker was not passing with the rising use of the rectifier. Jensen's rejoinder was that the rectifier could hardly drive steel-mill rolls and there would, therefore, still be the motors and motor circuits.

Issue was taken by C. F. Lincks (General Electric) on some of the Parsons-Wallace conclusions and he cautioned about their desire for higher fusing. He also said that three to six fuses in series had worked successfully in many installations. In particular, Lincks said that something must and will be done to avoid the need for choosing between the providing of proper over-current protection to the transformer and minimizing fuse blowing by lightning.

Relaying

A New Frequency Relay for Power System Applications. H. J. Carlin and J. L. Blackburn (both Westinghouse). Describes relay with inverse time delay which trips at an adjustably assigned frequency; designed to drop part of load to relieve local generators when ties open.

Current Transformer Output and Application Charts. R. Koller (Pacific Electric Mfg.). Develops charted ratio for determining optimum VA output through matching of transformers and burdens. Relaying examples detailed.

The Evolution of Standard Lines of CT for High Overcurrent Capacity. E. C. Wentz (Westinghouse). Design considerations behind development of family of current transformers appropriate for switchgear.

A New Carrier Relaying System. T. R. Halman (Detroit Edison), **S. L. Goldsborough** and **H. W. Lensner** (both Westinghouse), **A. F. Drompp** (Detroit Edison). Without resort to potential transformers, the positive-zero sequence filter in conjunction with carrier gives basis for simplified protection by comparing phase positions of currents at ends of carriered section.

George Steeb (Buffalo, Niagara and Eastern Power) said that Carlin's frequency relay paper would have been rendered more helpful if it stated how fast and at what frequency the relay opens: also what happens on loss of voltage. J. T. Logan (Georgia Power Co.) said his company prefers inertia type underspeed relays; they avoid the danger of breaking up the system unnecessarily on drop in frequency.

W. K. Dickinson (General Electric) agreed with author Wentz that field test was the only practical method of determining distortion of current transformer elements. Even a slight distortion should be considered to be a failure, he felt, because it weakens the insulation. Wentz, in closure, pointed out that if the inner coil of the transformer is symmetrically located there can be no axial forces on it but that in manufacture symmetrical location is not possible. The center coil cannot be located closer than $\frac{1}{16}$ in. Therefore there will be axial forces and the transformer will go to pieces from axial distortion first.

J. T. Logan (Georgia Power Co.) pointed out that a scheme similar to the carrier relay system described by Halman, Drompp, Goldsborough and Lensner had been developed on the Georgia Power system over the past three years and was described in ELECTRICAL WORLD of April 17, 1943. In a sharp attack on the authors in support of Logan's prior development, E. E. George (Southwest Power Pool) deplored the lack of recognition of Logan's work. "When the power company fellows develop a piece of equipment it is generally because they can't get what they want from the manufacturers," George pointed out. He expressed hope that the technical program committee would take steps to see that operating company engineers who contribute to a field of development have an opportunity to have their say.

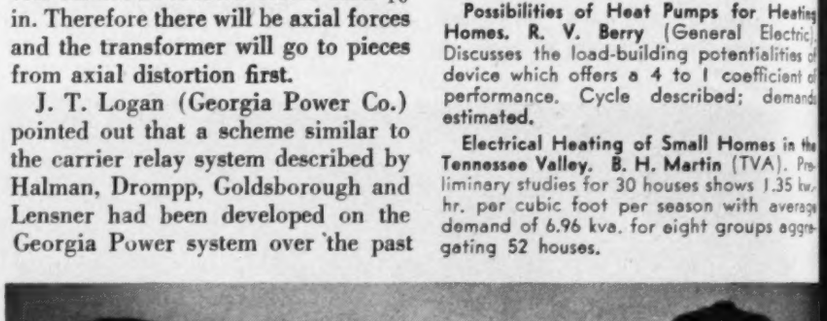
Heating Houses Electrically

Load Calculation Procedure for Electric Panel Space Heating. B. F. Raber and **F. W. Hutchinson** (both University of California). Mathematical basis for heat-balance approach to numerical solution for typical room conditions; 64.8 F. as comfortable as 70.6 F. with convection heating at same electrical input.

Electrothermal Space Heating and Air Conditioning. G. H. Krueger (Bonneville Power Administration). Economical distribution system favored by storage of heated water at 200 psi.; sensible heat released as heat of vaporization; good load factor. 5-room cottage equipped for test.

Possibilities of Heat Pumps for Heating Homes. R. V. Berry (General Electric). Discusses the load-building potentialities of device which offers a 4 to 1 coefficient of performance. Cycle described; demands estimated.

Electrical Heating of Small Homes in the Tennessee Valley. B. H. Martin (TVA). Preliminary studies for 30 houses shows 1.35 kw.-hr. per cubic foot per season with average demand of 6.96 kva. for eight groups aggregating 52 houses.



A. J. Krupy, Commonwealth Edison; H. A. Dryar, Philadelphia Electric; B. G. A. Skrotzki, Consolidated Edison

H. E. Wulfing, Commonwealth Edison; C. E. Asbury, Illinois Power; J. C. Parker, Memphis Light, Gas & Water Dept.; L. W. Smith, Doble Engineering; R. T. Henry, Buffalo Niagara & Eastern; M. S. Oldacre, Commonwealth Edison; J. R. North C&S

Reverse Refrigeration Applied to a New Haven Office Building. E. H. Walton, C. A. Williams (United Illuminating). Energy requirements varied from 68-1 to 76 kw.-hr. per degree day (630,000 cu. ft. office and public spaces and 940,000 cu. ft. garage and shops).

Shadow effect in panel heating is considerable (B. H. Martin, TVA). Difference between radiant and good convection system is not large in well insulated rooms (G. W. Penney, Westinghouse). Experimental work with portable screens using semi-conducting varnishes has showed comfortable conditions with 0.1 watt per sq. in. (T. F. Peterson, American Steel & Wire).

In discussing the Krueger paper lower pressure was suggested (S. J. Levine, General Electric) and more comparative data requested. In a community of 400,000 people 1,600 off-peak installations would throw the heating on peak (C. H. Leatham, Monongahela West Pa.). Others referred to this possibility.

The water table is a serious problem to the heat pump in the Eastern states (C. I. Hall, consulting engineer) and in large cities when water availability is limited some other source is suggested. The need for reliability was stressed by many.

Using direct method in hot air or hot water furnaces (F. L. Lawton, Aluminum Co. of Canada) 0.4 cent per kw.-hr. compares with 13,500 B.t.u. coal at $14.00 or oil at 10 cents; electrothermal storage offers promise of closing gap between 0.4 cent energy and the rate that may be found to be profitable.

Actual co-efficients of performance are less than theoretical values due to losses in equipment (E. H. Walton). Even when recovered the heat is at a one-to-one basis instead of the COP 1 to 3.

Electric Welding

Rating of Electrical Equipment under Intermittent Load. Myron Zucker (M. G. Rees, Inc.). Develops nomograms to correct for the inaccuracy from averaging duty-cycle time because of ignored grouping of impulses. Develops new definition for duty factor toward better economy of design.

An Improved Electronic Control for Capacitor Discharge Resistance Welding. H. J. Bichsel and **E. T. Hughes** (both Westinghouse). Provides full-cycle discharge through medium of ignitrons, thyratron firing tubes, flux-setting rectifier and capacitor bank; gives 3-phase balanced load on single-phase welding.

The Design of Low-voltage Welding Power Distribution. C. A. Adams, J. R. Fletcher and **A. C. Johnson** (all E. G. Budd). Mathematically supported recommendations for bus designs to give not over 5 percent voltage drop considering coincidence probabilities, mechanical strength and temperature rise.

Commenting on the "kickless" water-cooled welding cable mentioned in the Zucker paper Comfort A. Adams (E. G. Budd) questioned whether its water passages might not be different when the cable was old than when new. He pointed out that while the cable might be kickless it was not kickless as far as the conductors were concerned and under the influence of forces between conductors, vibration and age, fine stranded conductor might lead to clogging. Zucker reported this has been overcome.

The Bichsel-Hughes capacitor-discharge resistance-welding paper precipitated a discussion of this type merits compared with the shunt-tube welder. Edwin Callender (E. G. Budd) listed three disadvantages of the flux reseting system: Reverse current makes derating of the capacitor bank voltage necessary; weldability is less than for the shunt-tube system and it involves a multiplicity of apparatus. C. E. Smith (Taylor Winfield) corrected the author's statement that the flux reset scheme cuts tip arcing by pointing out that action of the ignitron cutting out at current zero is what kills tip arcing. C. A. Adams questioned whether the reverse wave flux-reset system gave energy availability comparable with the shunt-tube scheme.

Discussion of the welding power distribution paper by Adams, Fletcher and Johnson brought from L. W. Clark (Detroit Edison) a simplified method of approximating the probable maximum equivalent continuous welding current resulting from coincident "hits" of a number of welders operating simultaneously. By Clark's methods probable maximum equivalent continuous welding current is the sum of the equivalent continuous current of the largest welder (equal to the maximum current times the square root of the duty cycle) and 60 percent of the sum of the equivalent continuous currents of the other machines in the group. Experimental data comparing calculated and measured currents showed reasonable agreement for Clark's method. D. L. Beeman (General Electric) pointing to the importance of primary impedance in welder supply circuits, suggested use of series capacitors to keep down this component of total voltage drop.

R. O. Askey and E. R. Hendrickson (Public Service of Northern Illinois) in a conference paper, described a voltage translator scheme which improves lighting voltage conditions on circuits supplying welder load by interposing an impedance in the supply line, through a transformer arrangement such that voltage drop through the impedance caused by either the main feeder load or fluctuating load will appear as a voltage rise to the other load. The scheme admittedly translates improved voltage for lighting at the expense of voltage to the welder. It does increase voltage regulation to the welding customer.

Editorials

S. B. WILLIAMS, *Editor*

Republican Platform and the Utility Industry

READING BETWEEN THE LINES in the Republican 1944 platform, one gathers that the party favors government hydro projects to provide jobs during periods of under-employment but would leave to private industry the marketing of the energy. Nowhere is public power mentioned, but "a program for flood control, inland waterways and other economically justifiable public works" is called for. However, the platform calls for taking government out of competition with private industry. Its adherence to the principle of private enterprise is further shown by its pledge to foster air and merchant marine service under private ownership and management.

The only time electricity is mentioned in the platform is in connection with rural service when "sound extension of rural electrification" is proposed. This, coupled with "support of the principle of bona fide farmer-owned and farmer-operated cooperatives," might be taken as an endorsement of the principle on which REA operates. This conclusion is bolstered by the fact that Republican members of Congress with few, if any, exceptions are as ardent supporters of rural electrification as are the Democrats.

One of the most interesting parts of the platform from the standpoint of the power industry is that which would avoid "federalization of government activities." This plank covers a lot of territory and is subject to many interpretations among which can be read local autonomy for federal power projects instead of Washington control and removal of legislative and judicial power for administrative agencies. Such a principle would decentralize the federal power program placing the administration in local hands, as contrasted with the New Deal program which in the pending Rivers and Harbors and Flood Control bills, would, if passed, concentrate within the Department of the Interior, the marketing of the power produced.

So far as we can see, the Republican platform contains nothing that would lead one to believe that it will attempt to erase any New Deal legislation affecting utilities, but it does come out strongly against government competition with private enterprise, and condemns an "attitude of arrogance" on the part of government bureaus. The elimination of these two difficulties would probably do more than anything else to encourage the power industry to expand quickly and become a very important factor in creating post-war employment.

Uninformed Advertising Men

HOW CLOSE are utility advertising men to the problems outside their own particular operating area? At one of the sessions of the recent meeting of the Public Utilities Advertising Association, it developed that a number of those present were uninformed on many national problems. Because they were not immediately affected by government power programs, they knew little or nothing about them or their implications.

These are the men who have most frequent contact with the press and most of them are charged with some responsibility in their company's public relations program. How can they be so provincial? Whose fault is it that they have such a confined outlook? Can it all be charged to them, or has management perhaps been guilty of not advising with them on these national problems?

When TVA was first threatening private operation in the Southeast it was almost impossible to get others, either in the utility business or outside, to "view with alarm" the ultimate results. These activities of government, regardless of where they occur, are of national import. For that reason, local companies cannot wait until trouble is at their own door before taking action. The time to prepare the public mind is beforehand. Later may be too late.

Some day industry may have a public information service but in the meantime management not only must insist that those who have any responsibility in molding public opinion become acquainted with the national problems of the industry in such a way that they can best protect the industry's interests in their own areas, but it must help these fellows to get a better understanding.

Return of Puerto Rico Properties to Owners

ANNOUNCEMENT WAS MADE a few days ago by the Office of Defense Transportation that it has returned the American Railroad of Puerto Rico to private operation because possession, operation and control "are no longer required for successful prosecution of the war." This immediately raises the question about the San Juan and Mayaguez properties which the government took away from the owners in the early summer of 1942. Will they be returned?

The railroad was taken over in May of last year because labor difficulties disrupted the service. The power properties which were taken over a year before that, however, faced no interruption to service because

hey had gone through the worst of the dry season and t the time were but a few days away from the wet season.

The railroad was taken over in accordance with an stablished war procedure, but the procedure established y the War Production Board power branch for handling ny power shortage through the application of L-94 was gnored.

The railroad was taken over with full intention of eturning it to its owners, but the power companies were xpropriated and later the owners were paid. If ever here was a flagrant case of bureaucratic arrogance, it as the Puerto Rico power seizure.

No, we are afraid the San Juan and Mayaguez power roperties will not be returned to their private operation.

Coal Situation Improving

THE COAL SITUATION which appeared so critical early n the year looks better and better each month. Each najor user of coal has improved its supply on hand, with he utilities showing not only the largest number of days torage but the greatest improvement. As of the first of une the utilities were up to 83 days, which is 24 days etter than the low at the end of January.

Coal production has been running steadily over the welve million tons per week needed to cover this year's equirements so that if nothing unforeseen happens in the ext few months we should be able to weather the year ithout any mandatory conservation orders.

The weak spot is still dealer storage which stood at 9 days the first of June. Since a shortage in dealer tocks this winter would do more than anything else to ccentuate a fuel shortage and thereby bring on mandatory onservation, it is to be hoped that some way can be found o correct this situation now.

More Excess Profits Rate Investigations

AS WAS PREDICTED in our last issue, the effect of the tatement of the Secretary of the Treasury that he would ot interfere with rate reductions made at the expense f excess profits taxes has been more reduction proceedngs. Almost at once the California Railroad Commision and the Kentucky Public Service Commission started nvestigations.

The California commission contends that the excess profits taxes are misnamed because in effect they are paid y the consumer in addition to a fair return and thus do ot come out of company's net. It will be interesting ndeed to see if the net that the California companies ind up with at the end of the year is equivalent to as reat a return upon the investment as the commission thought fair before war excess profits taxes were levied.

Then having determined that point, the commission ight want to find out whether all the customers or just certain group of customers were responsible for the improved utility earnings. Where utilities supplying war industries have enjoyed greater earnings and a better net it will be found that it was due very largely, if not entirely, to the greatly improved load factor of the industrial business. There has been but little increase in the residential or commercial usage.

Should these excess earnings, if there are any, go to the customers who have made them possible or to the customers who have had no part in them? And as the new chairman of the board of Detroit Edison said before the Michigan Commission in a similar hearing, might not such excesses go back to the government because it was the cause of the increased war orders that made the earnings possible?

These so-called excess profits are a great temptation to regulatory bodies. Individual residential customers won't get much, but the aggregate looks fine in the record. The manner in which the commissions handle these cases, and there undoubtedly will be more of them, will be a test of wise regulation.

Third Phase of Utility-Dealer Relationships

DEALERS IN THE PACIFIC NORTHWEST have just been given a picture of the post-war promotion plans of the manufacturers, wholesalers and utilities in that area. A series of regional meetings lasting during the first half of June and sponsored by the utilization section of the Northwest Electric Light and Power Association laid the groundwork for the co-ordinated selling that will be needed when appliances are again available.

An activity of this kind might well be undertaken by every local utility association. If more and more dependence is to be placed on dealers to sell load-building devices they must know more about the objectives of the utilities and of their suppliers so they can make their own plans.

The war has paved the way for the third and permanent phase of utility-dealer relationships. The first phase came to a halt in the late twenties with the wave of anti-merchandising legislation to be followed by a period of dealer recognition and development. The next phase which we expect to see take root after the war is co-ordinated marketing wherein the objectives and needs of all elements of the trade are dovetailed. Certain groups are working on such a program right now and it should prove fruitful.

If such a program should mature, it would mean participation of the dealers in the planning. It would mean that the dealers would be informed on future promotions and not just given a program that was cut and dried. It would mean that dealers, wholesalers, manufacturers would confer both at the national and the local levels.

Now, when post-war plans are in the making, is a good time to start discussing them with the dealers. Much can be gained in getting ready and lots more can be gained in dealer good will.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

REA Inquiry a Fiasco

IT HAS NOT BEEN made clear by the Senate sub-committee investigating the Rural Electrication Administration to what extent the inquiry will proceed hereafter.

The committee will have to do something further if it intends to leave the field with honor, for up to now, it has made a sorry mess of an inquiry which could and should have done considerable good. At present the committee has four major points hanging in mid-air, and its work will be essentially valueless if it fails to resolve them.

First, the committee must settle the allegation of forgery against one of its exhibits. Of what evidential value can be the mass of disputed testimony in the four-volume record if the committee is unable or unwilling to demonstrate conclusively the integrity of a very important exhibit which has been alleged a forgery.

REA Administrator Harry Slattery testified under oath that he saw and copied the disputed letter, allegedly written by his former deputy Robert B. Craig, which mentions the latter's presence in Washington "working on a blockbuster for Clyde." Craig's attorney has challenged the authenticity of this committee exhibit and produced another letter, sworn to be the original, which contained no such phrase.

Unresolved Charges

Then there is the committee's interim report that "there was more than a legitimate and ethical connection between some of the REA engineers . . . in relation to the selection of conductors and other construction materials." The report mentions no names, but the record is dotted with names, and shows exactly who is referred to in the report. None of these men has ever been heard, although counsel promised repeatedly that each would be.

No one can expect the committee to determine whether copper conductor is better than aluminum conductor, for there is no unanimity here among electrical engineers. But the committee can be expected to determine, after full and fair hearing, whether public servants acted improperly, and it can be expected to act properly on its findings. To date, the committee has not conducted a full or fair hearing of this matter, thus it has palpably failed in its duty, and compounded the failure by an unsupported charge.

Inadmissable Evidence

The committee owes it to the public, if not to itself, to do a more workmanlike job on that part of the record which relates to the mysterious "Mexican Affair." Study of this part of the record indicates conclusively only that there was a "Mexican Affair" in which REA knowingly was involved. It is impossible to determine from the record whether the "Mexican Affair" was a legitimate and good neighborly interchange of information which might be helpful to public rural electrification in Mexico, or whether it did, as was inferred by official reports of Agriculture Department investigators, concern the military security of the United States.

While Craig's testimony in this regard is so confused as to indicate at best that he cared little what kind of record he left behind, the committee and its counsel should be ashamed to accept as "evidence" relating to military security the trash which was compiled by Agriculture Department investigators. Not only are agriculture personnel less than authoritative sources on military security. Their findings relative to the possible pro-axis connections of persons with names similar to that of an acquaintance of Craig are so hedged with qualifications as to constitute a travesty on the word "evidence." (hearings, part II, p. 265.)

Not only should the committee determine whether there is any basis for inclusion in the permanent record of such flimsy inferences and strike them if no such basis be found, it should—as it has not done—get to the bottom of just why an REA employee by her own statement in a report to Craig, had been working continuously, "arranging contacts and appointments with construction and equipment companies with whom I had personal acquaintance, in an effort to locate companies with the proper equipment, and who desire to enter into contracts with his state in Mexico for road work, bridges, additional landing fields for their own airlines, etc., all of which are in line with the state's program of development." (hearings, part II, exhibit 30, p. 255.)

Then there was the committee's handling of witness Vincent D. Nicholson, first deputy administrator of REA, who has been an upper bracket man since REA was organized. Nicholson, who fails to go all out for either Administrator Slattery or the opposing faction, now headed by Deputy William J. Neal, had been commended to the committee by several witnesses as one of its best possible sources on the vagaries of REA policy. He had made an improper remark shortly before he was called to testify. On that basis, his testimony on REA was refused.

Did or Didn't He?

If the committee believed that Nicholson meant "to Hell with the law" when he said that, the committee should have done its best to procure his dismissal. If the committee did not believe he meant it, but felt only that he had been indiscreet, it should have censured him and then heard his expert testimony. By its failure to discipline Nicholson, the committee indicated its belief that he had not meant what he said. Certainly the record thus far is not so imposing that it can afford to dispense with the relatively non-partisan testimony Nicholson stood to give.

It is suspicious to find the administration trying to squelch an investigation as its Senate handyman, Scott Lucas, did consistently in this case. And it is disheartening to find Senators of the caliber of the REA Committee lending themselves to such a performance.

NEWS OF THE WEEK

California Board Poised to Cut Utility Rates

Plans to investigate charging of war taxes to operating expenses—"Show Cause" notices sent to 130 utilities—Kentucky Commission also takes action on rates

California Railroad Commission took preliminary steps last week toward studying possible rate reductions with the purpose of saving residents of the state large sums by denying to utilities the right to charge war taxes to operating expenses.

The commission sent "show cause" notices to 130 utilities, each having gross revenues exceeding $250,000 annually, ordering them to submit within thirty days figures on their 1943 operating revenues, operating expenses, Federal income taxes, including excess profits, and their net revenues.

Since its authority to adjust rates is confined to California, the commission instructed the utilities to segregate their intra-state from inter-state accountings.

"The investigation," Richard Sachse, commission president, said, "deals with a matter of the most-far-reaching importance, affecting not only a large number of utilities and transportation companies under the jurisdiction of the commission, but practically every one of the millions of utility rate payers in the State of California. The amount of money involved and reflected in rates now being paid by California rate payers is very large and certainly exceeds $100,000,000 per year."

The question of "proper and equitable" disposition of utility war taxes, Mr. Sachse added, "is assuming greater importance with the prolongation of the war and with the increasing amount of war taxes levied by Congress upon all corporations and individuals.

"There is a good deal of confusion and misunderstanding with reference to the so-called profits tax paid by the utilities," he continued. "Such taxes are considered by the utilities as operating expenses and not as a charge against the company's net earnings. This means that these taxes are not paid by the utilities out of their profits but are paid by the patrons of the utilities as an operating expense in addition to the profits which are allowed the utilities in the fixing of the rates as a 'fair return'."

Kentucky Probe ordered

"The result is that utilities whose net earnings come within the excess profits brackets fixed by Congress are relieved from and escape the payment of war taxes in whole or in part.

"They are in a position to transfer such war taxes to the rate payers and to add this tax burden to the private individual's own tax burden."

Preliminary bout on the same subject will be held in Los Angeles July 27 when the Commission will hear the case of Southern Counties Gas Co., Pacific Lighting Corp. subsidiary, ordered to show cause why its rates should not be reduced, in which the war tax and excess profits transfer issue arises.

Not without precedent in California, the question arose in 1918 when the Commission subsequently ruled that Western States Gas & Electric Co. cease allowing war taxes as operating expenses. The same decision was handed Los Angeles Gas & Electric Corp. the following year.

Last week the Kentucky Public Service Commission ordered Hugh B. Bearden, principal consultant, "to enter into an examination of the revenues, operating expenses, federal taxes, and income of utilities subject to the jurisdiction of the commission and report to the commission the possibilities of reductions in rates of the utilities in the form of revised schedules or rate reductions by the refund method."

The order stated that the commisison had "in mind press releases expressing the attitude of the Secretary of the United States Treasury regarding reductions in utility rates and the effect of such reductions upon Federal taxes derived from such utilities, particularly excess profit taxes."

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Funds Released For New Grand Coulee Line

Funds for the construction of a 40-mile power feeder line from Grand Coulee dam to Brewster, Wash., are provided for in a $485,000 item which the senate and house recently recommended for inclusion in the current appropriations bill.

Congressman Walter Horan, in a telegram from Washington, D. C., said the appropriation was approved on the grounds that many small enterprises now exist and more are possible if cheap power is made available to those seeking opportunities in the area the proposed feeder line will serve.

Construction of the line is expected to be delayed, however, until the early post-war period.

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May Split REA Head to Three-Man Board

Rumors of an administration compromise which would accept independence for the Rural Electrification Administration but place it under a three-man board rather than a single administrator were widely discussed in Washington this week, but there was nothing to indicate how accurate they might be.

No immediate action can be taken in any event, for replacement of a single administrator by a three-man board would require legislation, and Congress is not expected to resume sessions until after Labor Day.

As discussed in Washington, Administrator Harry Slattery would be one of the three board members, with the other two to be appointed by the President and confirmed by the Senate. Any tendency Slattery might have to operate counter to Administration wishes, it was pointed out, would then be controlled by two opposing votes which could override Slattery much as Dr. Arthur E. Morgan was continually over-ruled some years ago by his associates on the Tennessee Valley Authority, David Lilienthal and Harcourt Morgan.

If the rumors be accurate, they would presage a new slump in the jurisdiction and general consequence of Agriculture Secretary Claude R. Wickard, who currently controls REA and who is fighting to keep control of REA. Wickard, of course, has been under fire by the Senate Agriculture sub-committee investigating REA, but few informed observers indicated any strong belief that the committee would be able to slug through Congress its legislation restoring REA to independent status. Currently, there is no doubt but that Wickard is firmly in control of REA and the prospects probably can fairly be assumed to be that he will retain this control until he is deserted by the President, from whom all his authority stems.

Meanwhile, Chester Lake, one of Slattery's recently-discharged aides, began his hunger strike on schedule June 29, and was reported to have lost three pounds the first day. Lake notified the president about two weeks ago that he would "eat no more" after June 28 until he or the Congress "frees REA for the farmers of America."

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FPC Approves Utility's "Show-Cause" Proposals

The Federal Power Commission announced today its order approving proposals by The Empire District Electric Co., Joplin, Mo., to eliminate from its electric plant accounts amounts totaling $7,401,815.97 in write-ups and other amounts representing excess over original cost.

Empire, a Cities Service Co. subsidiary, filed its proposals in response to the Commission's show-cause order of November 1941, and as a result of conferences between representatives of the Empire District Electric and the FPC staff.

Post-war Plans Discussed At Utility Conference

Stress intensified training programs—Utilities to share responsibility for post-war employment—Post-war appliance market rests on shoulders of utilities — Start sales program plans now

Planning of sales training, public relations, community and system development programs by utilities must be intensified if the industry is to be ready for the heavy responsibilities that face business after the war, industry spokesmen told more than 300 Iowa utility men recently at the post-war planning conference of the Iowa Utilities Association in Des Moines.

Opening the conference Gov. Bourke B. Hickenlooper of Iowa said that the gravest responsibility facing business, post-war, is to find adequate outlets for the personal genius of returning soldiers who will have aged in maturity and responsibility. "We must recognize their improved ability to assume and discharge responsibility. They will ask business, 'Where can you put our abilities to fitting use?' Upon our answer to this question depends the opportunity for prosperity left in this country," he affirmed.

If we fail to assume the responsibility which goes with the privilege of doing business, government will have to move in and provide jobs, B. F. Pickard, president, Interstate Power Co., Dubuque, warned in urging continuing and intensified post war planning by utilities. Utilities should assume their full share of responsibility for post war employment; support state and national utility organizations; sell themselves to the public and assume leadership in business development programs, he advised.

"We in the utility industry have a post war job to do in protecting free enterprise, particularly our own," C. A. Leland, president of Iowa Power & Light Co., Des Moines, declared. "We should seek to achieve four objectives: To sell more kilowatt hours; build more plants; distribute our power cheaper and give better service," he asserted.

Turbo-generator standardization and

PLAN JOB OPPORTUNITIES—Studying organization chart of "Jobs Incorporated," a community committee planning post-war job opportunities at Albert Lea, Minn., are l. to r.: W. Fred Stevens, regional utility engineer, WPB, Chicago; L. L. Perry, Interstate Power Co.; C. A. Leland, president, Iowa Power & Light Co.; W. R. Blake, Iowa Utilities Association; B. F. Pickard, president, Interstate Power Co., and C. E. Meyers, Interstate Power Co., Albert Lea, Minn.

IOWANS STUDY POST-WAR PLANS—Assembled to discuss the various problems confronting the electrical industry after the "shooting-war" is over, are l. to r.: E. F. Miller, Iowa-Illinois Gas & Electric Co.; J. F. McLaughlin and F. A. Beatty, Iowa Power & Light Co.; C. A. Hummel, Interstate Power Co.; Harold Rowe, Ambro Advertising Agency, Cedar Rapids; L. O. Tisdale and E. C. Nichols, Iowa Electric Light & Power Co.; C. E. Greenwood, EEI., and Ford Bates, Nebraska Power Co.

tabilization of demand for such units offer the utility industry two major opportunities for reducing the purchase price of generating units according to Richard C. Sogge, General Electric Co. If utilities can stabilize their demand for the manufacture of generating units by adopting forward purchasing policies, savings of 15 percent in purchase price are possible. However, he cautioned, forward policies can't be established if apparatus is not fixed in design. Stability of ceiling pressures, temperatures and unit sizes would make it feasible to buy on longer futures and the savings that would result from forward purchasing would be in excess of lower costs achieved through increased production of identical units, Sogge asserted.

W. Fred Stevens, regional utility engineer, WPB, Chicago, while doubting the existence of any definitely formulated plan as to the sequence of release of construction materials and appliances, foresaw that No. 6 & 8 weatherproof wire, transformers and meters would be among the first items to be released. Stevens said that 240,000 were released in the first half of 1944 and estimated that 260,000 would be released in the second half of this year. After meters, Stevens believed transformers would be the next item to be freed, and would undoubtedly be one of the early items released.

Utility post-war selling tactics, rather than simple merchandising competition with dealers will be the thing the trade will watch, C. E. Greenwood, Edison Electric Institute said in calling for a unified code of merchandising practice as the basis for cooperation between utilities and the trade. Utilities can pin the blame for most of the conflict with dealers on its too-liberal time payment terms, he affirmed. The utility obligation in post war merchandising is along the lines of pioneering, promotion and direct seling. "We must strive to make load building a profitable business for dealers," he said.

Responsibility for a good part of post war appliance market development rests on the shoulders of the utility industry, L. E. Moffatt, Editor, *Electrical Merchandising* asserted. Its past activities in leading, directing and educating dealers cannot be relaxed but must be expanded in the face of the increasing number of new and unprepared people who will enter the merchandising field after the war. Liberal terms are as important as low prices in appliance selling, he declared in warning that groups seeking to keep Regulation W in effect after the war are "shouting into the wind".

Urging the utility industry to start now to plan its post war sales organization and lay out sales training programs, A. H. Jaeger, Edison General Electric Appliance Co., Chicago, told the conference that 30 percent more people must be employed and 40 percent more goods sold during post war years than any pre-war, to keep up present production levels. New men will enter the field that will have to be trained. Start planning your training program now but make it logical, simple, full of common sense and interesting to the men, he urged.

"If we are to have prosperity in America after the war it must begin in your own home town, C. E. Meyers, Interstate Power Co., Albert Lea, Minn., told the Iowans in discussing CED post war planning activities in Albert Lea. "No one can give you your freedoms," he asserted." You must get them for yourself through community post war planning." In Albert Lea market surveys by CED reveal a potential mark for $12,000,000 in durable goods in the two years following war. Potential unemployment will be kept to between 200-600 out of 6,500 employables, he predicted through activities of a local job planning committee.

Fred H. Gunther, Iowa Power & Light Co., cautioned the utility industry not to be complacent in the face of Diesel engine competition. To meet the threat the industry must be on the alert offensively and not defensively and must tell the story of low-cost, flexible, electric motor power. We have been delinquent in telling our story in the past, he said.

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WPB Releases 91,000 Additional Meters

An increase of 91,000 units in the second-half production quota of domestic watt-hour meters has been approved by WPB, but the 260,000 meters which are to be made by the end of the year will be short of requirements by an estimated 80,000, necessitating continuing repair and conversion of existing meters, Office of War Utilities officials announced this week.

Meanwhile, Order L-151, governing manufacture of meters, has been amended to provide WPB's radio and radar division with a quick formula for establishing meter production quotas.

Utilities have been urged to be sure that meters they list for sale under the excess inventory provisions of Order U-I are meters which can be used by the purchasing company and not obso-

lete types for which repair parts are not available or meters in such disrepair that they are of little if any use. Listing of such meters as available for sale has created a false picture of the meter supply. Utilities were urged to list all possible meters which can be sold, to be sure that all so listed are useable, to sell them at reasonable prices and to junk those meters which are not useable so as to prevent their being listed in excess inventory reports.

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Makes $6,750,000 Bid on Missouri Utility

An offer of $6,750,000 by the City of Springfield, Mo., for the properties, assets and common stock of the Springfield (Mo.) Gas & Electric Co. was made public by Herschel Bennett, Finance Commissioner for Springfield, at a recent SEC hearing.

The city is opposing Federal Light & Traction Co.'s proposed sales of the Springfield Gas & Electric common stock to Ralph H. Teed, Hot Springs, Ark., for $650,000 cash.

Mr. Bennett said that $1,350,000 of the city's purchase price would be allocated to the common stock, but that Federal has refused to negotiate with Springfield. Counsel for Federal said it did not negotiate because it had been advised that the city has no legal authority to issue revenue bonds to finance the purchase.

AIEE Speaker Advocates Round Table Discussions

Warns chaos may result from lack of co-operation among groups—Management and labor must get together—A well-ordered scheme of taxation must be devised

A solemn warning that the United States, following a brilliant war achievement, can fail to sustain its eminence through lack of adequate governmental and social planning was sounded last week in St. Louis by Dr. William McClellan, chairman of the Union Electric Co. of Missouri, in an address before the American Institute of Electrical Engineers.

Unless business, labor, farmers, professional men and government sit down around a table now and build the social-governmental frame within which the production and distribution of goods is to be achieved in the years following peace, all of our efforts to sustain production at necessary high levels will be stymied, Dr. McClellan affirmed.

"Being stymied means utter confusion. History shows that when there is disunity and confusion the worst elements in society make progress. All groups are planning but there is no one national plan in the making for domestic life or for international relations," he pointed out.

"Government must reorganize itself so as to perform efficiently and at least expense," Dr. McClellan stated. "Management and labor jointly must install a system of conference and action—so that goods and services may be had at the lowest possible prices," he continued.

"A well ordered scheme of taxation must be devised so that all groups will pay their proper share—wages, salaries, dividends must be allocated so that every man and woman shall be an adequate purchaser in order to have whatever his station entitles him to have for a satisfactory life. A system of money, credit and tariffs must be arranged which will give permanent stability to our whole economic process, both domestic and international," Dr. McClellan pointed out.

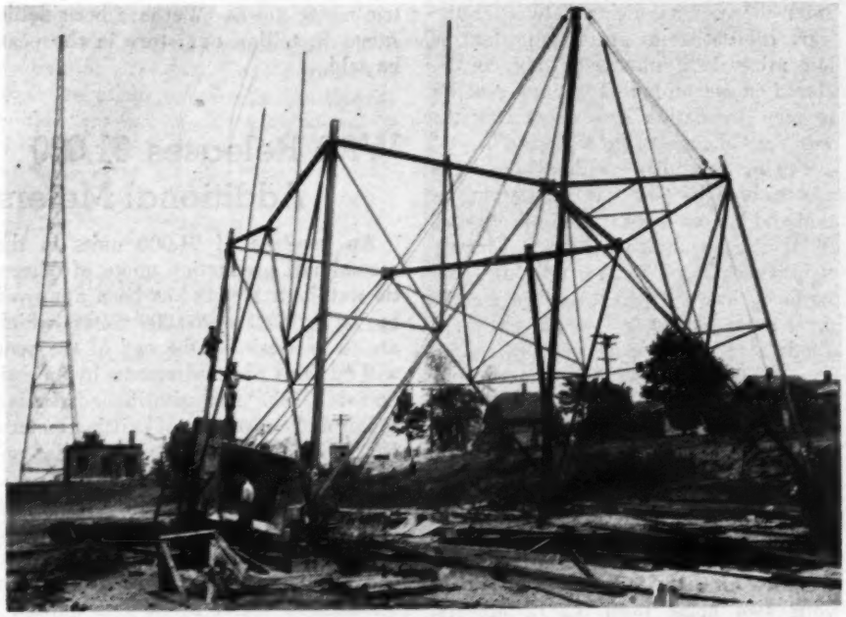
Getting this frame for national progress is a joint responsibility of all working together, he stated.

"The sad fact at present is that there is no such joint planning. Farmers, labor, business, professional men and government are all planning but separately," Dr. McClellan indicated. "We can have government of, by and for the people, but only if the people plan together, not in separate groups," he declared.

Other Speakers

In an address commemorating the sixtieth anniversary of the A.I.E.E., Dean W. E. Wickenden, Case School of Applied Science traced the development of the Institute from a band of 25 charter members to the present time when it has the largest membership of any engineering society. When the Institute was formed in 1884, Dean Wickenden pointed out, that series arc lamps for street lighting were coming into use, there were 150,000 telephones in operation, but alternating current was not yet introduced. Yet even then one of the Institute's earliest papers by Prof. Houston was laying the foundation for modern electronics with a discussion of the causes for the then new Edison effect.

F. E. D'Humy, Western Union, speaking on the occasion of the centennial of the Morse telegraph pointed to the many present-day industries which owe



SALVAGE AID—Towers of radio station WEEI, formerly located on the grounds of Boston Edison's Edgar steam plant at North Weymouth, Mass., yield enough steel upon dismantling to make approximately 69,000 hand grenades. Since Pearl Harbor Boston Edison has salvaged 603,530 lbs. of paper, 2,606,535 lbs. of non-ferrous metals and 1,922,350 lbs. of ferrous metals or 140 carloads of scrap material

their beginnings to the telegraph. Twenty-one of the original 25 founders of the A.I.E.E. were telegraph men, he pointed out.

Dean A. S. Langsdorf of Washington University, who was in attendance at the 1904 International Electrical Congress in St. Louis 40 years ago, traced the achievements of this body in setting the international standards of electrical terminology used throughout the engineering world today. Meetings of this body have been interrupted by the war, he stated, but we may look forward to their being resumed in years to come with benefit to the industry and the world at large.

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Study State Control of Central Valley

Climaxing a hearing, during which Interior Secretary Harold L. Ickes' "social ideas" were blamed for delaying construction of the Central Valley Project, the California Water Project Authority on June 27 ordered a preliminary study of the possibility of state operation of the project.

The hearing was conducted at Sacramento, Calif. and, at its conclusion, the Authority instructed State Engineer Edward Hyatt to prepare a report on the probable cost of a complete review of the issue and the feasibility of state management of the project.

Charges that Secretary Ickes and the U. S. Bureau of Reclamation are using the Central Valley Project "as a weapon of coercion to impose upon our people a program of social changes developed and fostered by bureaucrats in Washington", were made by Roland Curran, secretary-manager of the Central Valley Project Ass'n.

Continuing his criticism of the Interior Secretary and of the Reclamation Bureau, Mr. Curran declared that while the project was conceived as an irrigation undertaking, construction of the irrigation units has been prosecuted with little diligence and that no major unit of the project has been completed despite the expenditure of $160,000,000 and a lapse of 10 years.

Mr. Curran's charges were supported by E. G. Burke, president of the influential Kern County Farm Bureau, who attributed the delays to Secretary Ickes' "social ideas" and the failure of the Reclamation Bureau to cooperate with interested local agencies in formulating CVP policies.

Defense of Secretary Ickes' and Reclamation Bureau's policies was offered by California's Atty. Gen. Robert W. Kenny, a member of the Water Project Authority, who attributed the delays to the fact that "a war is on and needed materials have been diverted to war industries".

That California would find it difficult, if not impossible, to gain control of the project even if it decided to make the effort, was considered a foregone conclusion. Control of the project now rests in the hands of the Federal government and to relinquish that control to California would require an act of Congress.

Attorney General Kenny in a statement made upon his return to San Francisco pointed out that while California voted a $170,000,000 bond issue 10 years ago to finance construction of the project, a relatively small amount of money has been expended. Of the nearly $160,000,000 spent to date, about $133,000,000 was supplied by the government, he said.

LOOKING TOWARD GREATER SERVICE—Staff managers of Connecticut Light & Power gather at Waterbury to study post war appliance supply and servicing problems. Commercial and local managers were well represented in the conference. L. to r., J. T. Sherlock, W. J. Dunne, K. L. Gilson, A. W. Borg, C. A. Duggan, A. C. Faneuf, R. Weidaw, B. J. Crampton, W. M. Walsh, A. C. Bristol, C. A. Byron, V. R. Kiernan, K. E. Buffington, W. I. Lyon, J. A. Ryan, S. Kileen, F. J. Mellon. Second row, left, H. R. Blackman and S. Manchester

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W. H. Sammis Elected Head of Ohio Edison Company

Walter H. Sammis, vice-president and a director of the Commonwealth & Southern Corp., was elected last week president of the Ohio Edison Co., Akron, one of the operating units in the Commonwealth & Southern system.

He succeeds A. C. Blinn, who was elected to the chairmanship of the board upon the resignation of Justin R. Whiting of New York, president of Commonwealth & Southern. Mr. Blinn has been identified with Ohio Edison and its predecessors since 1916, and had been president since 1938.

Prior to becoming president of Ohio Edison Co., Mr. Sammis resigned as a director and vice-president of the Commonwealth & Southern Corp. and as a director and vice-president of Consumers Power Co. He will reside in Akron.

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Arkansas Power Rate Base Established

Using the "prudent investment" formula, the Arkansas Utilities Commission has established a $47,996,290 rate base for the Arkansas Power & Light Co. and directed the utility to reduce its electric rates $975,000 a year, effective, May 10, 1944.

The finding came after months of hearings by the commission and terminated dispute among the Arkansas board, the Federal Power Commission and the power company over the rate base yardstick. FPC had advocated the "original cost" formula and Arkansas Power the "reproduction cost" theory.

The effect of the order will be to cut $975,000 from the company's revenue.

The state commission held that neither the original cost nor reproduction cost is an accurate method of determining the rate base.

C. Hamilton Moses, president of the utility, indicated that the utility would appeal the order to state courts.

Detroit Edison Denied Rehearing by Court

Michigan Supreme Court action eliminates consideration of war taxes as operating expense in setting utility rates

The Detroit Edison Co.'s petition for a rehearing by the Michigan supreme court of its decision directing the Michigan Public Service Commission to ignore excess profits taxes paid by utilities in fixing rates, has been denied.

The commission has interpreted the decision as forbidding a public utility company to charge war taxes as part of operating expenses when determining rates. Last week the commission began hearings to determine whether the Detroit Edison Co.'s rates should be reduced. The Edison case is the first to come before the commission although all public utilities companies in the state were affected by the decisions. Hearings will be resumed July 10.

Meanwhile, James H. Lee, assistant comporation counsel for Detroit, has taken steps to have every city apply to the commission for rate reduction. "It is the duty of every city attorney in Michigan," he said, "to file a petition with the Michigan Public Service Commission, seeking public utility rate reductions," and added that "it is the duty of the mayor and the commissions of such cities to take steps to have it done," if any city attorney fails to file such a petition.

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Army 90-Day War Job Needs Skilled Men

The Army has asked skilled electricians to volunteer for 90-day employment on "vital war construction jobs" at the Hanford Engineering Works, Pasco, Wash., and the Clinton Engineering Works, Knoxville, Tenn.

The War Department has asked that men leaving normal jobs in the utility, electrical contracting and other electrical industries retain full seniority rights during their absence on these jobs. Payment is made at standard rates with total $100.65 for a 54-hour week at Hanford and $105 for a 60-hour week at Clinton. Dormitory accommodations and food are furnished for $14 weekly at Hanford, and $8 to $17 weekly at Clinton.

Volunteers who complete 90 days of satisfactory service at either plant will receive certificates of war service signed by the Undersecretary of War, and the employers who release them will be thanked by letter by the Under Secretary.

Local unions of the International Brotherhood of Electrical Workers will handle transportation and similar details, or information may be obtained from local United States Employment Service Offices.

The appeal was issued after conferences between the War Department and President Edward J. Brown of IBEW and Laurence Davis, general manager of the National Electrical Constructors Association.

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Utility Head Opposes Sale of Facilities To City

T. B. Wilson, president of the Louisville Gas & Electric Co., issued a statement expressing opposition to the acquisition of the company by the city (ELECTRICAL WORLD, July 1, page 4).

Mr. Wilson, who participated in recent discussions in Chicago concerning possible purchase of the company by the city, said:

"I am opposed to municipal ownership because I believe the citizens and the City have been and can be better served by a private company, and our board of directors concurs in this opinion. . . . There are many obstacles to the purchase of our property by the City and some of them appear unsurmountable."

•

MEETINGS

Edison Electric Institute—Accident prevention committee, E.E.I. headquarters, New York, N. Y., September 12-13. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 25-27. Brent Wiley, managing director, Empire Bldg., Pittsburgh 22, Pa.

Previously Listed

American Institute of Electrical Engineers—Pacific Coast technical meeting, Biltmore Hotel, Los Angeles, Calif., August 29-September 1. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

International Association of Electrical Inspectors—Northwestern section, Olympian Hotel, Olympia, Wash., August 21-23; E. B. Morrison, secretary, P.O. Box 70, Portland, Ore. Southwestern section, Modesto Hotel, Modesto, Calif., August 28-30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, Claypool Hotel, Indianapolis, Ind., September 11-13; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, DeWitt Clinton Hotel, Albany, N. Y., September 18-20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Ainsley Hotel, Atlanta, Ga., September 25-27; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

Illuminating Engineering Society—Annual convention, Edgewater Beach Hotel, Chicago, Ill., September 14-16. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

Indiana Electric Association—Annual fall meeting, French Lick Springs Hotel, French Lick, Ind., September 20-22. E. F. Hauser, secretary-treasurer, 1414 Circle Tower, Indianapolis, Ind.

Municipal Electric Utilities Association of New York State—Annual meeting, Lake Placid Club, Lake Placid, N. Y., September 26-28. T. J. McKee, secretary, 200 E. Third St., Jamestown, N. Y.

Transformer Stocks Cut, OWU Reports

A slight reduction in the backlog of 1.5–5 kva. distribution transformers has been effected in three months operation under Direction 1 to order U-1, requiring approval of purchases by regional utility engineers, the Office of War Utilities reported this week, but the restrictions will be maintained for some time.

At the end of May, OWU told members of the power and distribution transformer industry advisory committee, the backlog had been reduced by 1,160 transformers to 32,340. Direction I will be kept in force to reduce this backlog further and keep facilities free for the manufacture of radio and radar transformers. It is anticipated that requirements for the last half will equal those for the first half unless unexpected demands by the military and lend-lease complicate the supply picture.

Committee members told OWU that porcelain for busings is assuming bottleneck proportions since increased demands for porcelain items have been made by the military. Carbon steel plates and sheets still constitute a serious problem, OWU was told.

•

Return "Over-Earnings" To Public, Board Rules

Nova Scotia Public Utilities Board has rejected two applications and granted one of the Eastern Light & Power Co. supplying light and power for Sydney, North Sydney, Sydney Mines, and other centres on Cape Breton Island. Petitions turned down by the provincial board were (1) that surplus earnings of the company be given to the government in the form of the excess profits tax; (2) that a discount apply only to domestic customers. The proposal favored by the board was for an interim reduction in rates.

The board, in its rulings contended that all over-earnings should be returned to the public in the form of reductions in rates, and also that all classes of customers should participate in the benefits accruing from such reductions.

Output Curve Moves Slightly Upward

The output curve moved slightly upward during the week ended July 1, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,327,359,000 kw.-hr., as compared to the figure of 4,325,417,000 kw.-hr. for the previous week, which ended on June 24. Figures for the week represented an increase of 5.3 percent over the 4,110,793,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was 3,424,188,000 kw.-hr.

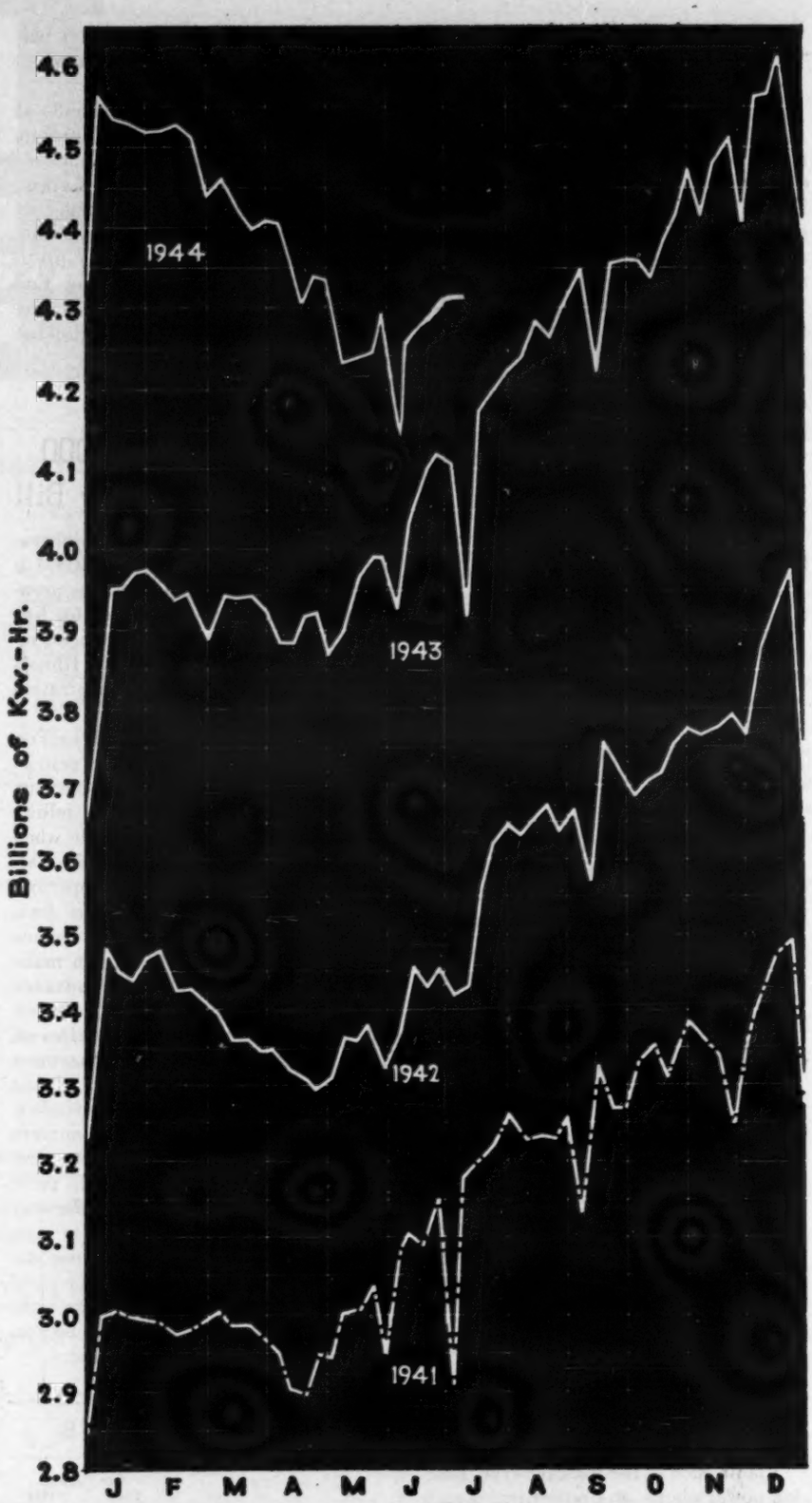
Six of the seven major geographic regions of the country reported increases for the week over the corresponding week last year, the Pacific Coast states continuing to hold first place with an increase of 15.6 percent. The Southern States ran second second with an increase of 8.2 percent. The Mid-Atlantic states converted a loss of 1.3 percent for the week ended June 24 into an increase of 0.1 percent for the week ended July 1, as compared with the corresponding week last year. The Rocky Mountain group showed a decrease of 6.6 percent.

Weekly Output Millions Kw.-Hr.

1944		1943		1942	
July 1,	4,327	July 3	4,111	July 4	3,424
June 24	4,325	June 26	4,120	June 27	3,457
June 17	4,287	June 19	4,098	June 20	3,434
June 10	4,265	June 12	4,040	June 13	3,464
June 3	4,144	June 5	3,926	June 6	3,372
May 27	4,292	May 29	3,990	May 30	3,323
May 13	4,238	May 15	3,969	May 16	3,357
May 6	4,234	May 8	3,904	May 9	3,365
Apr. 29	4,336	May 1	3,867	May 2	3,305
Apr. 22	4,344	Apr. 24	3,925	Apr. 25	3,273
Apr. 15	4,307	Apr. 17	3,917	Apr. 18	3,308
Apr. 8	4,361	Apr. 10	3,882	Apr. 11	3,321

Percent Change from Previous Year

	Week Ending		
	July 1	June 24	June 17
New England	+ 0.6	+ 3.3	+ 2.7
Mid-Atlantic	+ 0.1	— 1.3	— 1.2
Central Industrial	+ 5.5	+ 5.2	+ 4.8
West Central	+ 5.7	+ 6.2	+ 3.9
Southern States	+ 8.2	+ 8.4	+ 6.3
Rocky Mountain	— 6.6	— 9.1	— 8.5
Pacific Coast	+15.6	+15.4	+16.5
Total United States	+ 5.3	+ 5.0	+ 4.6



No Second Vote on PUD Bonds, Court Rules

Clearing the way for purchase of properties of the Mountain States Power Co., the Oregon State Supreme Court recently held that the Tillamook Peoples' Utility District's $750,000 bond issue, approved in 1940 by voters of the district, cannot again be placed on the ballot.

Acting in accordance with provisions of the measure approved by the voters, directors of the Tillamook PUD adopted an ordinance a year ago authorizing the issuance of the bonds. Their move was halted, however, when 18 taxpayers filed a referendum to permit the district voters to decide at the 1944 general election if they wanted the bond issue.

The Supreme Court decision held that the voters had already expressed their approval of the bond issue, and that issuance of the bonds was an administrative act, rather than a legislative one.

ASME Holds Mid-Year Meet In Pittsburgh

Industrialists planning to build new power plants or to modernize obsolete coal-burning equipment were urged by E. C. Payne, consulting engineer, Consolidated Coal Co., New York, in an address at the semi-annual meeting of the American Society of Mechanical Engineers held in Pittsburgh, to make a thorough study of the competitive steam production costs of available coals prior to the design of new equipment. "Because of the fact that there are tremendous reserves of bituminous coal, it is generally recognized to be the fuel of the future for power plants," he said.

Describing fuel facts that should be developed prior to the planning of new plants, or the modernization of obsolete equipment, Mr. Payne urged adherence to "first things first," and declared that an investigation should be conducted to reveal all the facts on availability, quality and delivery cost in order to forecast a competitive steam production cost prior to the design and installation of new steam generating equipment.

M. J. Manjoine, research engineer for Westinghouse Electric & Manufacturing Co., spoke about machines which reveal in a matter of hours how steel alloys for gas turbines will perform over a ten-year period. "Studies on these test devices," he told the American Society of Mechanical Engineers, "are paving the way for the development of new and more powerful gas turbines. We can now determine more accurately than ever before how metals react under the constant load and high temperatures they are exposed to in a gas turbine."

Discuss portable plants

Power trains were discussed by C. M. Laffoon, manager of the A. C. generator engineering department, Westinghouse Electric & Manufacturing Co.; Otto de Lorenzi, Combustion Engineering Co., Inc.; and F. G. Ely, the Babcock & Wilcox Co.

These portable plants are designed for use by the armed forces of the United Nations in prompt restoration of electric service in both urban and rural areas recaptured from the enemy.

Plants such as the package-type, floating power plants, and power trains each capable of producing electrical power rapidly, have been developed to meet the emergency needs created by enemy destruction and devastation.

Nominations for the 1945 officers of the American Society of Mechanical Engineers were announced by George Nicastro, chairman of the nominating committee, who is with the Combustion Engineering Co., New York. Election of the nominees will be held by letter ballot of the entire AMSE membership, closing September 26, 1944.

Alex D. Bailey, Vice-President of the Commonwealth Edison Co., Chicago, is the nominee for President. Nominees for Vice-President are: David Larkin, vice-president and general manager of the Broderick and Bascom Rope Co., St. Louis, Mo.; J. E. Lovely, vice-president, Jones & Lamson Machine Co., Springfield, Vt.; and Thomas S. McEwan, vice-president, McClure, Haddon & Ortman, Inc., St. Louis, Mo.

•

REA To Get $5,000,000 Under New Bill

The Rural Electrification Administration would get an extra $5,000,000 a year with which to finance studies preparatory to the approval of loans for line construction under a bill introduced recently by Sen. Scott Lucas, Illinois Democrat and strong administration supporter.

An Agricultural Department spokesman explained that since WPB restrictions on material use in line construction prevent cooperatives from telling prospective rural customers just when lines to serve them can be built, farmers are reluctant to join co-ops and deposit $5 to $10 membership fees. Since such fees are used to finance studies required before REA can make construction loans to co-ops, advance planning of new projects has suffered. The bill, it was explained, authorizes an appropriation of $5,000,000 for payment to cooperatives, contractors or almost anyone else who will make these studies.

It was emphasized that the surveys which would be made under the proposed program would be much more detailed than those currently under way by REA as part of its post-war program. REA currently is compiling statistics on unserved farms in every rural county in the country, as well as making other studies, but none will be specific enough to base loans upon.

UTILITY REPORTS

	Net Income 1944	1943
*Alabama Power	$4,262,386	$4,705,972
*Arkansas Power & Light	1,297,279	1,276,538
*Connecticut Light & Power	3,741,902	3,716,491
*Consumers Power	7,633,792	7,750,521
*Dallas Power & Light	1,298,437	1,496,547
*Georgia Power	5,458,420	6,303,451
*Houston Lighting & Power	2,889,979	3,193,914
*Idaho Power	1,353,814	1,263,359
*Iowa Southern Utilities	425,189	414,931
*Louisiana Power & Light	756,078	1,360,698
*Mississippi Power & Light	570,924	790,346
*New Orleans Public Serv.	1,580,819	2,294,178
*Ohio Edison	3,055,581	3,223,898

*Twelve months ended May 31.

WPB Holds Up Output of Vacuum Cleaners

Reconversion of vacuum cleaner plants to civilian production cannot be permitted until a relatively large amount of materials, components, labor and facilities are available, WPB officials told the industry advisory committee recently.

No estimate can now be made of when such reconversion can be permitted, WPB men added.

When reconversion can be allowed, it must be effected speedily and production must be encouraged to reach the highest levels at which it can proceed without detriment to war production. Production ceilings will be maintained for some time to assure that war production does not suffer, WPB officials emphasized, but when broad reconversion is under way, such ceilings may be dispensed with or regarded rather as "floors" under production so that the maximum production may be attained and as many people as possible kept working.

It was made clear that no attempt will be made to hold all manufacturers in a given industry to one starting date for civilian production. Despite the competitive advantage which may accrue to a firm allowed to start civilian output ahead of the rest of its industry, plants will be cleared for civilian output as they can demonstrate their ability to do such work without harm to war production and as materials become available.

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Daniel C. Green Dies

Daniel C. Green, for many years prominently identified with the public utility industry, and chief executive of the Cleveland Pneumatic Tool Co., Cleveland, Ohio, since 1942 died on July 2 of undulant fever. Mr. Green was formerly president of the Middle West Utilities Co. and was appointed trustee of the utility when it went into bankruptcy in 1933 to effect its reorganization. He was 59 years of ago.

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Chromium Banned by WPB

WPB has prohibited the use of chromium metal for the manufacture of nickel-chromium resistance wire and the delivery of such wire for use in domestic or commercial electric appliances, effective immediately. The prohibition is contained in Direction 2 to order M-18-a, which provides an appeals procedure.

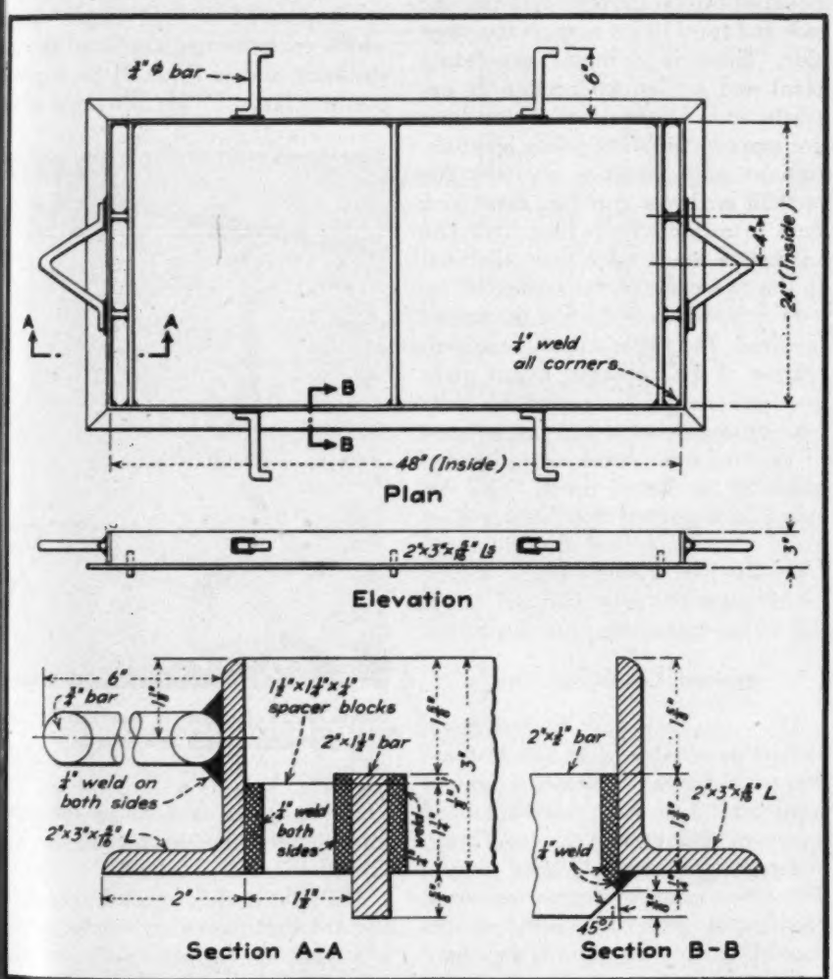
How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Welded Frame Better For Vault Grille

Welded grating frames are preferable to the older cast iron frames because they are self-cleaning, and rusting of the grating and the frame is eliminated. Where there is no chance for dirt to collect and hold moisture in constant contact with the structure, little or no corrosion occurs.

It is important to ventilate transformer vault installations to avoid overheating, continues Mr. J. J. Stelzer, Engineer, Commonwealth and Southern Corp., Jackson, Mich., in a paper presented in the Industrial Progress Award Program sponsored by the James F. Lincoln Arc Welding Foundation at Cleveland, Ohio. Therefore, the ventilator area must be liberal but not occupy too much of the sidewalk area. Prior to the design of the ventilator grating frame shown in illustration, various and generally unsatisfactory low net area structural designs were employed. All were subject to collection of refuse and dirt all around their edges, extreme corrosion occurred and all had a low effective, unobstructed area.



DETAILS of welded non-rusting sidewalk vault frame

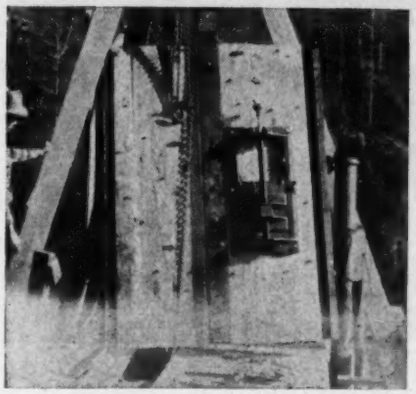
Cast iron gratings and frames were heavy, were structurally fragile and expensive, as the sizes required were varied and the quantities limited. This made the pattern cost a major portion of the unit cost. A 24-in. x 36-in. welded frame for 1½-in. Irving small mesh grating, made from angle, cost $12 each. A pattern for the cast iron frame would cost approximately $20. Individual welded frames cost 47 percent of single cast frames. In lots of six the saving was less, amounting to approximately 22 percent each.

The welded frame would weigh about one-fourth of the cast frame and be about 10 percent smaller due to the higher effective circulation area. The finished installation has a neat appearance and stays neat since there is no place for the sidewalk litter to lodge permanently in the corners of the frame causing untidiness.

•

Saves Lifting Flume Gate for Priming

In some small hydro plants taken into the system of the Appalachian Electric Power Co. difficulty was encountered with the lift gates at the heads of flumes. These gates were simple wood panels which warped and swelled as the years passed and were often hard to operate. When one of these plants was out of operation for



PRIMING gate installed in flume gate

any considerable time it was necessary to prime the flume occasionally to keep it from drying out and developing leaks. But to open one of these old gates partially in order to let a small amount of water into the flume was often a job of pretty heavy wrestling.

To avoid this trouble small screw-lift rabbet gates were set into some of the more obstreperous wooden ones, as shown in the accompanying picture. Now when it is necessary to prime a flume the rabbet gate is cranked open as required for the amount of water.

•

Tie Losses Figured for Voltage Upping

An unusual example of line loss allowances made by the Connecticut Valley Power Exchange resulted when one member company rebuilt a pair of transmission lines and increased the voltage from 66 to 110 kv. The enhanced transmission capacity was not needed for the company's own load but was to create additional savings on interchange, stated Mr. E. C. Brown of the Connecticut Valley Power Exchange at a recent P E A Systems Operation Committee Meeting. The pool reimburses the company for carrying charges on the added investment which was made. Line losses on the company's load are calculated on the basis of the 66 kv. lines as they existed before the changeover and the company is billed only for the reduction from 66 to 110 kv. line losses.

The preferred method of obtaining line losses is from compilations based on the results of an a.c. calculating board study. Combinations of system load and the allocation to different sources of supply are selected in advance and kw., rkva., amp., voltages and phase-angle readings are taken with varying amounts of interchange. I^2R calculations may be made from these to give the system losses for each condition. Curves are plotted of losses as functions of the different variables from which, by interpolation and extrapolation, the losses for other conditions can be read.

The power factors of the various lines change on the computing board as they do in actual operation, thus eliminating one of the big assumptions when line losses are based on calculations only.

Alternative Method

An alternative method would be a series of I^2R calculations based on assumed voltages, power factors, etc. from which would be developed curves or charts, to express the line loss as a function of the interchange.

One member's transmission system consists principally of a loop composed of two 66 kv. lines forming one side and two 110 kv. lines on the other side. There is a major generating plant and an interconnection at opposite ends of the loop. These lines are tapped at various points into substations and generating stations. The method used was to reduce these four lines to a single equivalent line. The substation loads were then allocated to the two ends of the system in inverse proportion to the line reactances involved. The r.m.s. value of the generation of the principal hydro plant on this system was secured from its load duration curve and the balance of the load was considered to be supplied by the steam plants. This resulted in a normal flow of power of given amount in one direction and from this base it was a simple matter to calculate the superimposed losses due to interchange in both directions.

Average Conditions Used

Line loss calculations for interchange power should be based on average and not maximum or minimum conditions. For this reason standard values of resistance at 25 deg. C. are generally the desirable ones to use. The current density versus resistance relations of conductors should also be taken into consideration as they may make more difference than temperature.

Line loss data should be prepared in tabular form so that the values to be used can be readily picked off by relatively unskilled clerks. The Exchange makes these line loss allowances on an hourly basis.

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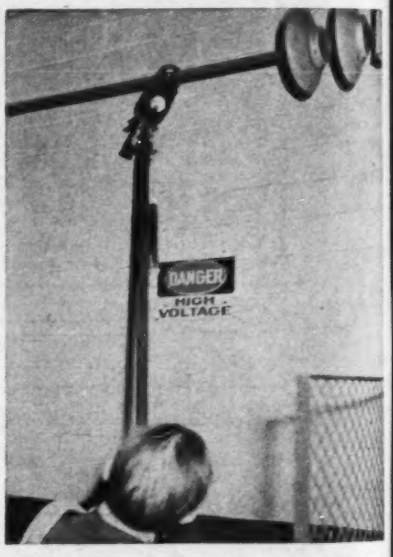
Clamps Tong Ammeter to Hot Line Stick

An adapter is shown in accompanying illustrations which provides means for attaching a tong-type ammeter to a hot line stick so that current readings can be taken with safety on high-voltage lines and in substations.

The device illustrated was designed by Transformer Foreman M. C. Solomon of Central Illinois Light Co., Peoria, after having been "caught" in the field and forced to lash a tong test ammeter to a hot line stick and improvise a pull string to open the split core.

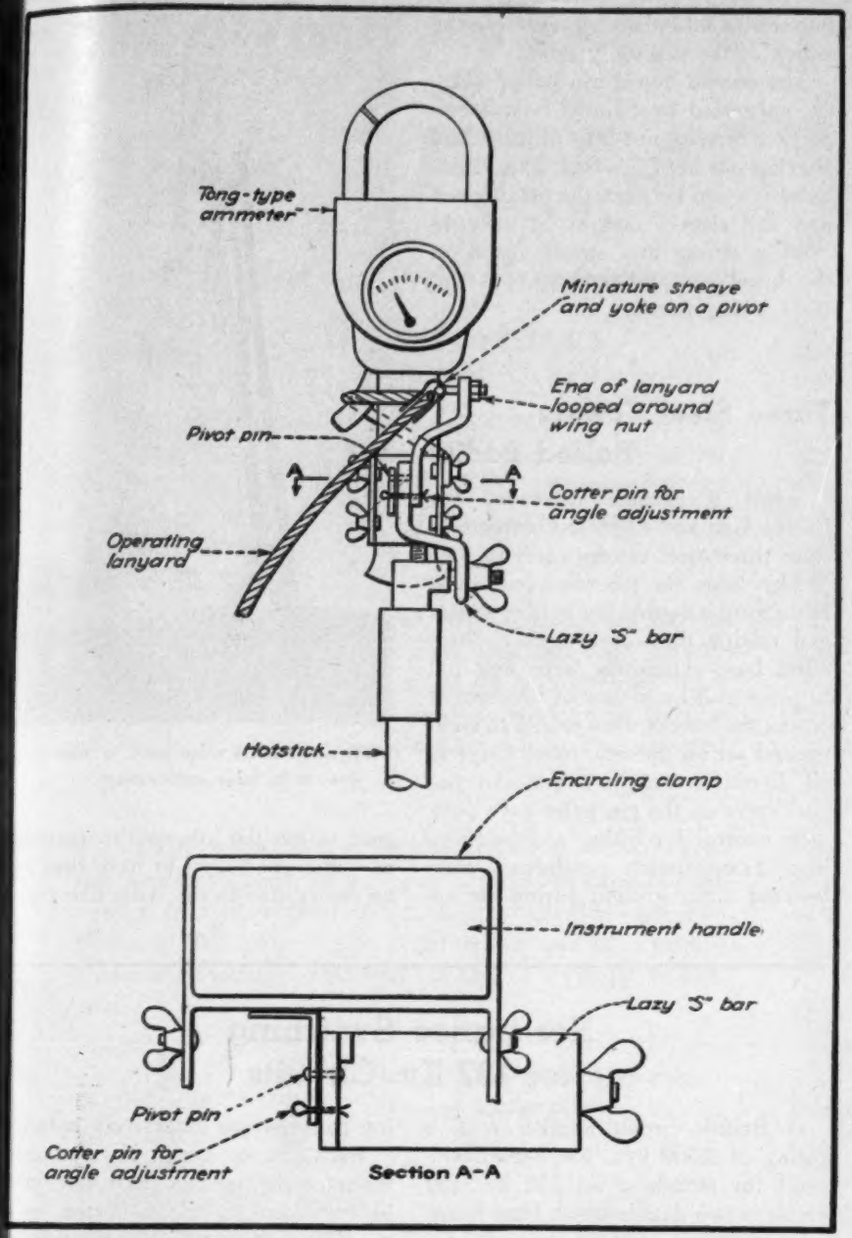
Simple in its elements, the adapter can be built in most shops with ease. It consists of a light metal clamp which encircles the handle of the instrument and is fastened by a pivot pin to a lazy "S" bar provided at its



TONG-TYPE ammeter in use on hot line stick providing safety to operator

lower end with a hold to take the threaded stud on the end of the hot line stick.

The split core is opened by a light lanyard that passes three-quarters of a turn around the instrument, over the core-opening lever and through a pivoted sheave and yoke. For protection



Design details for adapter which permits tong type ammeter to be used at end of hot stick for measuring currents in high voltage conductors

to the operator a length of wood or other insulating material should be inserted in the lanyard.

By changing the position of a cotter pin it is possible to tip the instrument at an angle to the hot line stick so that it can be read more easily by the operator.

• • •

Plugging Bolt Holes In Wood Structures

Proper plugging of open bolt holes in the members of wooden transmission and substation structures is an important construction detail which, if neglected, may accelerate deterioration through decay.

A sound practical method is used by the Union Electric Co. of Missouri transmission department, Rivermines, Missouri. Dowels $\frac{1}{32}$ in. larger than holes to be plugged are made up from the shell of an old pole. These are soaked in creosote and stored in a barrel of creosote solution before being used. In making the repair the dowel plugs are inserted in the bolt hole at both ends, regular commercial roofing cement is used to fill the middle of the hole. After the plugs are sawed off and trimmed it is scarcely possible to detect the patch.

•

Ground All Capacitor Terminals—Be Safe

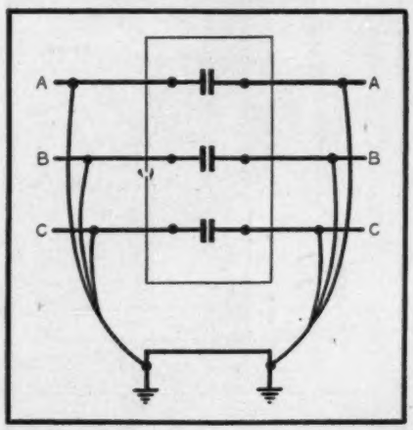
By S. H. POLLOCK
Assistant Supervisor
Kansas City Power & Light Co.

Working on capacitors presents a problem different from that encountered with any other electrical apparatus. Disconnected from the line, they are not dead and safe to handle but actually may have a much higher voltage than the line from which they were disconnected. The only safe way to work on them is to ground each terminal and leave the grounds on until work is completed; then, and only then, remove them.

On series capacitors all six terminals must be connected to properly short the capacitor. Probably the safest way is to use two commercial short-and-ground sets and connect one set to each side of the capacitor.

Most commercial capacitors have a small high-ohmage resistor built in them which is connected across the terminals. It is supposed to discharge the capacitor to 50 volts in about five minutes. The resistor, however, is connected across the line continuously and is out of sight. Its failure cannot be seen; therefore, not too much faith should be put into its operating condition.

It is not particularly dangerous to short out a capacitor, for while the high voltage will cause some spitting, the amount of energy is small, about 1/22,500 kwh. per phase for a 180-kva. 3-phase capacitor.



METHOD of shorting and grounding all terminals of a series capacitor

The short-and-ground connections should be on the capacitor throughout the working period. This is necessary because a capacitor that has been only momentarily shorted may build up a new charge of dangerous proportions in a very short time.

•

Dowel Pin Pullers Two Types

Two types of dowel pin pullers suggested by employees are used effectively at General Electric's Schenectady Works.

One type (Fig. 1), suggested by

FIG. 1—Hammer type dowel pin puller

Francis Barton, has a knurled cylindrical sliding member which serves as a hammer. It slides along a shaft which is threaded at both ends. One end of the shaft is fitted with interchangeable heads threaded to fit various sized dowel pins. The other end of the shaft is fitted with a turned piece of machine steel which serves as an anvil against which the sliding member is pounded to remove the dowel. This device can also be used to drive dowel pins into place by reversing the action of the sliding member.

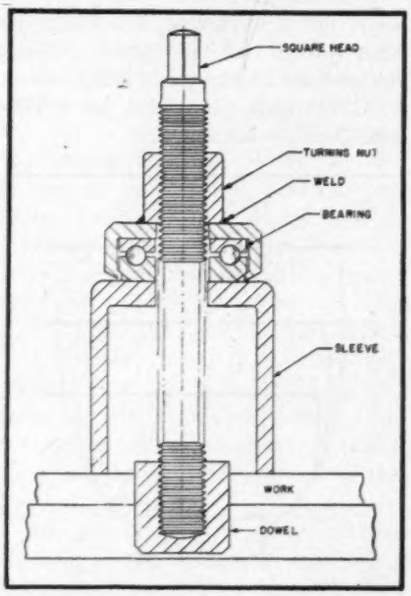


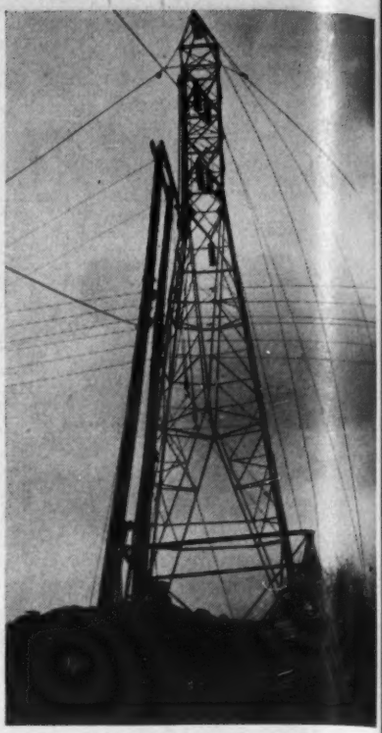
FIG. 2—Dowel pin puller has ball bearings to reduce wear on working parts

The second dowel pin puller (Fig. 2), suggested by Samuel Solini, employs a turning nut into which a ball bearing has been inserted. This eliminates friction between the turning nut and the sleeve, making it easy to exert a strong and steady force on the dowel pin, and reducing wear on the working parts.

•

Three Steel Towers Raised Bodily

When it became necessary for Pacific Gas and Electric Company to raise three steel towers carrying two 110-kv. lines, the job was easily done by rigging a double gin pole as shown and raising the towers bodily. New 20-ft. base extensions were first put in place and by means of two sets of blocks the towers were raised straight up and set on the new base. Guys in all directions on the tower and two back-quys on the gin poles gave complete control for lifting and positioning. Transmission conductors were lowered to the ground during the operation, but the job went so smoothly that this was found to have been unnecessary due to the Atlas-like gin.



TWO GIN POLES were used to raise tower to new 20-ft. base extension

Resistance Switching for 132 Kv. Circuits

A British circuit breaker with a rating of 2,500 kva. has been developed for switching on 132 kv. and employs two double-break blast heads per phase, one of them shunted by a wire-wound non-inductive resistor. As described by Messrs. H. E. Cox and T. W. Wilcox in a recent Institution of Electrical Engineers paper, the arc in the shunted break is extinguished first and the resistor then shunts L and C until the arc carrying the resistor current in the second break is extinguished. By this time the restriking-voltage transient has decayed to a negligible value.

When the value of R is made low enough, the restriking transient becomes practically independent of the natural frequency of the circuit on which the breaker is used, and is so reduced in peak value and rate of rise that the size of nozzle forming the shunted break can, for a given breaking capacity, be extensively reduced.

Each blast head is separately mounted on its own blast valve and air receiver, and is supported, by a post insulator, from a rigid tubular base in which are housed the electro-pneumatic control valves.

The restriking transient can be modified by means of resistance switching, so that by its introduction the breaking capacity and electric strength of the breaker can be controlled individually and independently.

By combining resistance switching with series multi-breaks, the distribution and exact shape of the restriking transient across each break can be accurately controlled. This means that "unit testing" of such breakers is completely valid. This will greatly increase the scope of existing test plants for testing high breaking capacity of air-blast breakers.

A RECORD THAT'S HARD TO BEAT

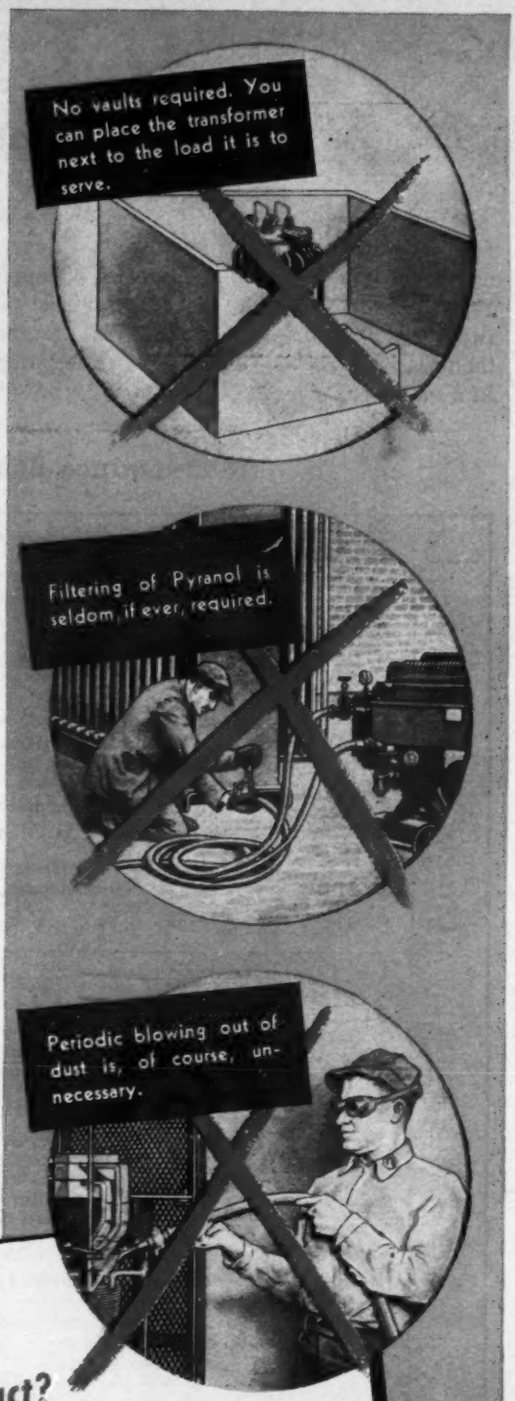
It's the reason for the trend to Pyranol transformers

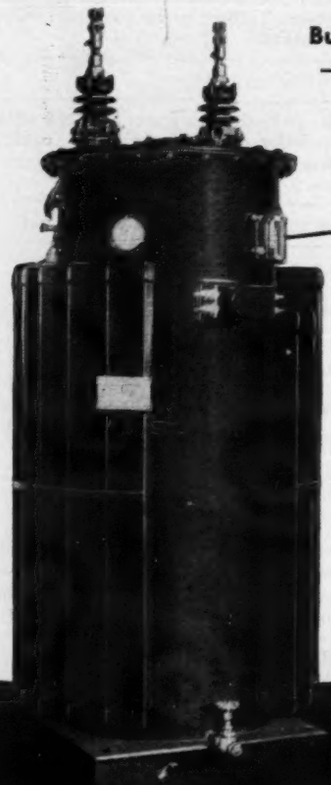
1. OPERATING RECORD 99.8 PER-CENT PERFECT—based on careful records of 12,000 Pyranol* transformers, totaling 2,000,000 kva, installed from 1932 to 1943 in *industrial plants*. In this ten-year period there have been *only* 23 failures.

2. NEVER A FAILURE DUE TO PYRANOL. In *not one* of these 23 failures reported during this ten-year period did the fact that the cooling liquid was Pyranol have anything to do with the failure. Furthermore, in not one of these 23 cases was anyone harmfully affected physically.

3. NEVER A FIRE WITH PYRANOL. In *no case* has Pyranol burned or contributed to a fire. In *no case* has its vapors formed explosive mixtures with the air. The National Electrical Code permits the use of Pyranol transformers indoors *without* the use of fireproof vaults.

*Reg. U. S. Pat. Off.


No vaults required. You can place the transformer next to the load it is to serve.
Filtering of Pyranol is seldom, if ever, required.
Periodic blowing out of dust is, of course, unnecessary.



Buy all the BONDS you can —and *keep all you buy*

Can you ignore the economic benefits of this time-proved product?

Why should you accept anything short of the greatest reliability, for your power supply? Can you afford unnecessary capital investment in such items as vaults and heavy copper, necessary when oil-filled transformers are used for industrial distribution? Can you afford to have your transformers exposed to dirt, dust, or oil vapors? Can you afford to ignore an operating record such as Pyranol transformers have produced?

For safety, savings, and reliability, specify Pyranol for your next indoor installation of transformers or load-center unit substations. Pyranol units are available for circuits up to 69,000 volts —our new bulletin, GEA-4193, will bring you additional facts. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Fire-Fighting Tool Maintenance Schedule

A maintenance schedule for fire-fighting installations with work to be done at stated periodic intervals, varying from a weekly schedule to two years according to the nature of the task, is one of the subjects treated in a recent paper by F. N. Beaumont, London Power Co., Ltd., and F. A. Geary, County of London Electric Supply Co., Ltd., and given before the (British) Institution of Electrical Engineers.

In the use of the gas (CO_2 or methyl bromide), either the whole section may be flooded or, as in the case of the new 22-kv. indoor substation, it may be released into the partially enclosed cubicles. This arrangement has been found to be not only effective but economical even when the cubic capacity is considerable.

Maintenance Schedule for Fire-Fighting Installations

	Type	Work to be carried out	Interval	Special notes
AUTOMATIC INSTALLATIONS	Water	Log water pressure Log air-detector line pressures	Weekly Weekly	Air lines liable to condensation to be drained quarterly; lines to be re-charged with air as required
		Routine-test motor and control gear	1 mo.	On some systems motors operate if water pressure drops below a certain mark owing to valve leakage. This test is inclusive of such operations
		Check indication and alarm systems	3 mo.	Test by operation of drainage valves in each section in turn
		Examine and overhaul motor and motor control gear	1 yr.	Liquid starters to be topped up as required. If storage tanks have automatic filling, examination to be made of ball valves, etc.
		Examine detectors, nozzles, etc.	1 yr.	Where possible make test by discharging installation for short period on outdoor switchgear and transformers; main filters to be cleaned
	Gas, CO_2 or methyl$_4$ bromide	Weigh cylinders	1 yr.	Cylinders of more than 10% drop in weight to be recharged. First check 6 months after installation
		Check automatic and manual valves. Operate gas-release mechanism, inspect nozzles, etc.	1 yr.	Where portable nozzles with reeled tubing embodied in installation, tubing to be carefully inspected for deterioration
		Check indication and alarm systems	3 mo.	———
	Foam	Test opened drums of foam powder or liquid; overhaul booster pump and control gear; routine-test motor and control gear	1 yr. 1 mo.	Take samples and mix with water to check adequacy of foam; powder types—inspect for "caking" or signs of moisture; dry all mixing chambers after test
		Test contents in 2-liquid type	1 yr.	Test for reaction by samples of each liquid
		Check automatic and manual valves	1 yr.	———
		Examine sprays, etc.	1 yr.	Pipes checked by compressed air
		Check indicating and alarm systems	3 mo.	———
PORTABLE EXTINGUISHERS	Foam portables and engines	Inspect all valves and nozzles, test contents	1 yr.	Test for reaction by samples from inner and outer containers, according to particular make
	Gas cylinder equipments, CO_2 and methyl bromide	Weigh cylinders	1 yr.	Particular attention to condition of hoses
	Soda-acid	Inspect valves and nozzles, test contents	1 yr.	Test for reaction by samples. Alkaline solutions need changing every 2 years in most types
	Carbon tetrachloride (CCl_4l_4)	Check that containers are full	1 yr.	CCl_4l_4 volatile, does not deteriorate
Water and foam hydrants		Inspect valves and hoses	1 yr.	"Wet" test canvas hoses for water or foam; inspect for deterioration
Breathing masks		Inspect condition, test pressure in cylinders	1 yr.	Keep apparatus in box, in cool dry position

How One Power Company Got Another 100 Kw from an Overloaded Feeder for a New Airport

PROBLEM. A small airport in the South needed 2300-volt service, the total estimated peak demand being 100 kw. The power company that serves the area had a 2300-volt distribution feeder, but it was already loaded to the point of causing trouble. This feeder originated at a substation on an 11-kv circuit at a point about 15 miles from the generator.

SOLUTION INCLUDED USE OF INDUCTION REGULATORS. In order to carry the new airfield load, the company extended the 11-kv feeder about 4¼ miles, to a point where the 2.3-kv feeder branched and continued in two directions. At this point, three G-E 75-kva transformers and *TWO G-E 12-KVA 2400-VOLT INDUCTION REGULATORS* were installed. The regulators not only made it possible to supply the airfield with the power required, but also improved voltage conditions on the two 2300-volt branch lines.

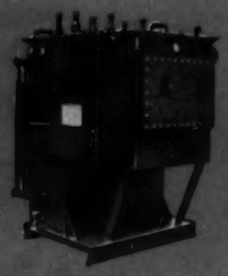
SAVINGS IN MATERIAL AND TIME

Improvement in regulation was needed because of the small conductors installed in this area. If regulators had not been used, it would have been necessary to extend the 11-kv feeder all the way to the airfield—by changing over a considerable portion of 2300-volt line to 11 kv. This alternative would have required a much greater expenditure of the critical materials so sorely needed for other war needs. Also, the ready availability of G-E feeder regulators and their ease of installation made the use of regulators the quickest method of doing the job.

If you need additional capacity, ask your G-E representative to estimate the savings in time and critical materials that can be obtained on your feeders with G-E feeder regulators, or write for Bulletin GEA-2762. *General Electric Company, Schenectady, N.Y.*

BUY WAR BONDS

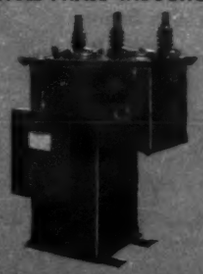
One of a series telling of wartime distribution problems being solved with G-E feeder regulators—applications where they saved critical materials or otherwise helped the war effort, like some jobs you may have.



THREE-PHASE STEP

SINGLE-PHASE INDUCTION

SINGLE-PHASE INDUCTION



SINGLE-PHASE STEP

DRY-TYPE INDUCTION

GENERAL ELECTRIC

FEEDER REGULATORS

STRESS CALCULATIONS FOR POLE LINE STRUCTURES—III*

By CARL G. ERICKSON, Electrical Engineer, Northern Indiana Public Service Co., Hammond, Ind.

Relationships among forces, reactions and stresses of wood two-pole transmission structures are explained here. Similar discussions for other forms of structures will be given in subsequent articles.

Two-Pole Bottom-Braced Structure

Combining the ideas shown in Figs. 2 (a) and 2 (b), ELECTRICAL WORLD, June 10, page 134 asymmetrical structure as in Fig. 3(a) is obtained. Here it is assumed that the vertical load W and the horizontal load P are transferred by means of the cross arm and equally divided between the two poles.

For this figure:

$$H_1 = H_2 = \frac{P}{2}$$

$$R_1 = \frac{\left(\frac{P}{2}+\frac{P}{2}\right)h}{X} - \left(\frac{W}{2}+W_1\right)$$

$$R_2 = \frac{\left(\frac{P}{2}+\frac{P}{2}\right)h}{X} + \frac{W}{2} + W_1$$

$$c = \frac{\left(\frac{P}{2h}\right)/h_2}{\sin\theta}$$

$$t = \frac{\left(\frac{P}{2h}\right)/h_2}{\sin\theta_1}$$

If the load P is of such character that its direction may reverse, then the stresses as calculated for members C and T will interchange and both members should be designed for both types of stresses.

In a structure of the type shown in Fig. 3(b), it can be seen that there is no stress in member T for loads as shown. For this structure R_1, R_2, H_1 and H_2 can be calculated by the same method as for Fig. 3(a). And:

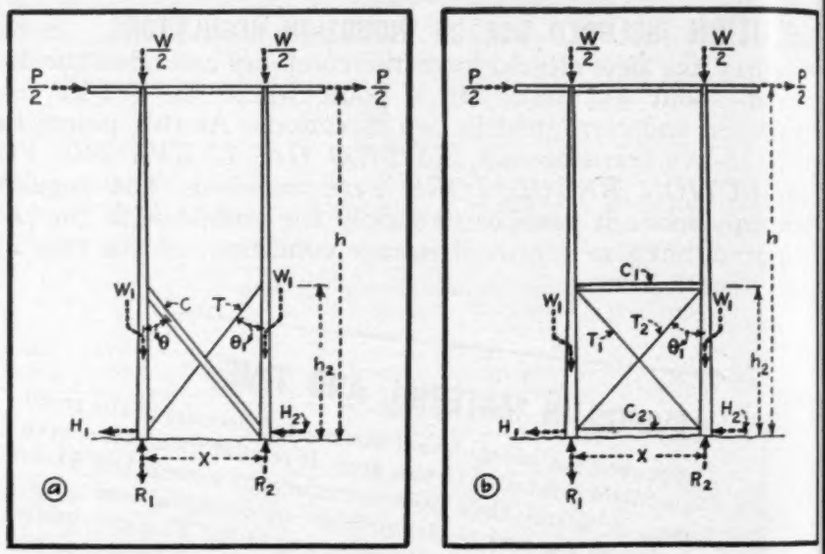


FIG. 3—Relationship between forces on two-pole structures with bracing near bottom; (a) X-bracing and (b) X-bracing with cross pieces

$$t_2 = \frac{\left[\left(\frac{P}{2}+\frac{P}{2}\right)h\right]/h_2}{\sin\theta^1}$$

$$c_1 = \left(\frac{P}{2}h\right)/h_1$$

$$c_2 = H_2$$

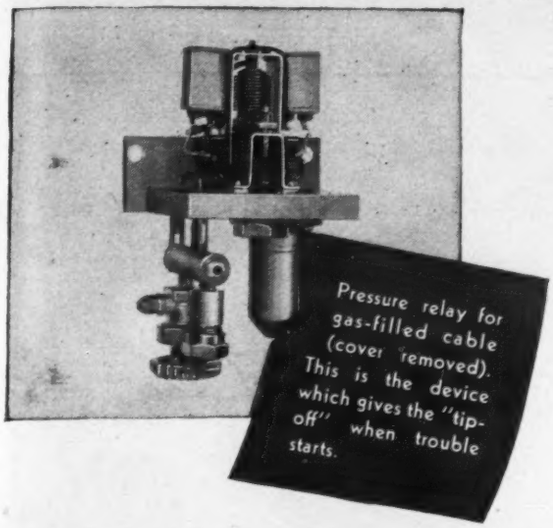
Only in case of reversal in direction of load P would member T_1 be required and then of course it should be designed similar to member T_2.

Ordinarily pole line structures are not designed with bracing near the ground line as shown in Figs. 3(a) and 3(b) because the bracing is too remote from the point of application of load. Actual calculations will show that reactions R_1 and R_2 and stresses in the bracing may be greater than if the bracing were higher on the structure.

It will be noted that the above calculations of stresses have been made on the basis of symmetrical structures, symmetrically loaded, and that where two diagonal braces only have been used, both of them take stresses, and where only one diagonal is stressed two horizontal braces are used.

*This series began in *Electrical World*, May 13, 1944, issue.

"Tip-Up" Simplicity in SELF-SUPERVISING CABLE



Pressure relay for gas-filled cable (cover removed). This is the device which gives the "tip-off" when trouble starts.

Like the ice-fisherman's "tip-up" signal, G-E gas-filled cable is constantly on the alert, and remarkably simple in its warning action. The self-supervising feature is obtained without complicating the installation.

This cable (Type GF) enables your maintenance department to get the jump on outages. The savings may be as great as $1000 to $1500 each time the alarm warns of sheath damage.

Repairing your cable at the first signal of a leak or injury costs comparatively little. Knowing about it right away enables the operating staff to forestall emergencies and to maintain service continuity.

Within the solid-cable range, the cost of GF cable is close to that of solid-type cable. At higher voltages, gas-filled cable is less expensive than any other type. Another feature: the technique of handling GF cable is little different from present methods familiar to cable engineers.

For further information, see your local G-E representative. *General Electric, Schenectady 5, New York.*

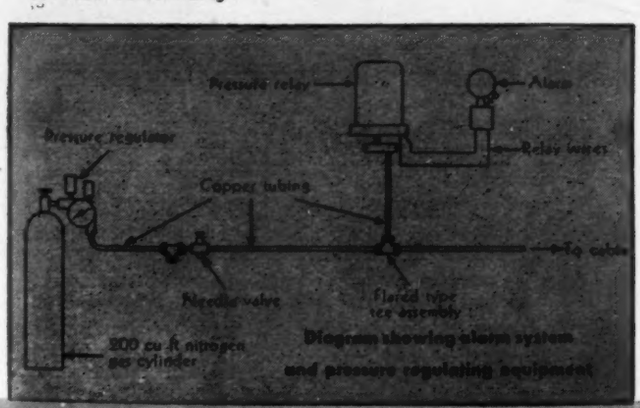


Diagram showing alarm system and pressure regulating equipment

Normal operating pressure of the pure, dry, inert nitrogen is between 10 and 15 pounds per square inch for low-pressure 10-kv to 40-kv lines. On 40-kv to 69-kv lines, the medium pressure is 40 pounds per square inch. In the diagram at left, the simplicity of the equipment is at once apparent. For GF cable lines up to 40,000 feet, a manually operated regulator and alarm system like this need be used at but one end.

GENERAL ELECTRIC

501-22-1200

Buy all the BONDS you can — and keep all you buy

CHART YIELDS FINAL COIL RISE IN A TRANSFORMER

By H. B. KEATH and W. L. J. F. GODIN† Wagner Electric Corporation, St. Louis, Mo.

The final hot spot temperature rise of a transformer coil after continuous operation, (loads of 15 minutes or more in duration) are given by the accompanying nomogram. Its design is based on the well established law that the copper rise in a transformer varies as the 1.6 power of the ratio of the percent load to the percent normal load (normal load 100 percent)

Chart is based on formula:

$$\theta_3 = \theta_3' \left(\frac{\%\ \text{overload}}{\%\ \text{normal load}} \right)^{1.6}$$

where

θ_3 = Final coil temperature rise and the following is known

θ_3' = Normal full load coil gradient

•

Example for use of chart

Given:

(1) 10 deg. C. average copper temperature above hot oil:

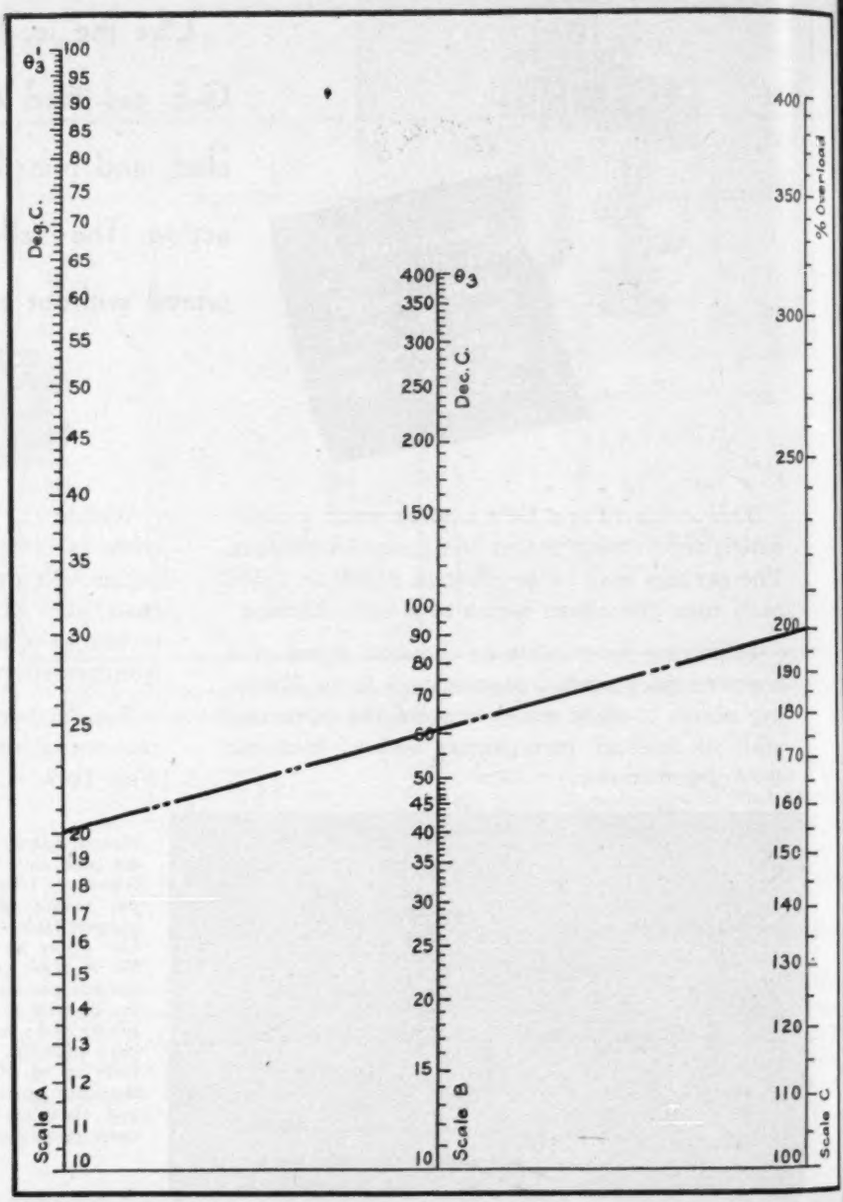
(2) 10 deg. C. hot spot correction; which makes $\theta_3' = 20$ deg. C. = hot spot copper temperature above hot oil.

Overload = 200 percent of normal rating

Connect point 20 (hot spot) on scale A to point 200 (percent overload) on scale C

Read on scale B final hot spot gradient of 60.8 deg. C.

•



† From bulletin "Normal and Emergency Loading of Power Transformers" written by the authors and presented at the 1943 MVEA Engineering Conference. See also issues of *Electrical World*, Mar. 11, 1944, page 116; April 15, 1944, page 118; May 13, 1944, page 122; and June 10, 1944, page 120.

PROTECT EQUIPMENT *with* GENERAL ELECTRIC FUSES

THESE are the same fuses General Electric uses to protect its own equipment. They provide reliable overload and short circuit protection. They are made of the finest materials and are thoroughly tested and accurately rated.

G-E Nonrenewable Enclosed Fuses 3-600 Amp., 250V. or 600V. Both indicating and nonindicating types are available.

G-E Renewable Enclosed Fuses 3-600 Amp., 250V. or 600V. Fiber bar supports link, provides proper alignment of terminals, facilitates replacement.

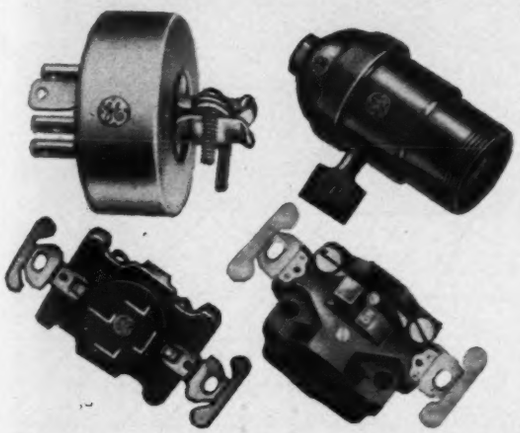
G-E Silvend Fuses with silver-plated contacts 3-600 Amp., 250V. or 600V. Designed for use with apparatus having silver-plated fuse contacts. Heating due to oxidation does not occur with this combination.

You'll find fuses of the correct type and proper rating for your requirements in the G-E fuse line . . . fuses that will assure adequate protection for your equipment.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday, 6:45 P.M. EWT, CBS.

BUY WAR BONDS

INDUSTRIAL WIRING DEVICES

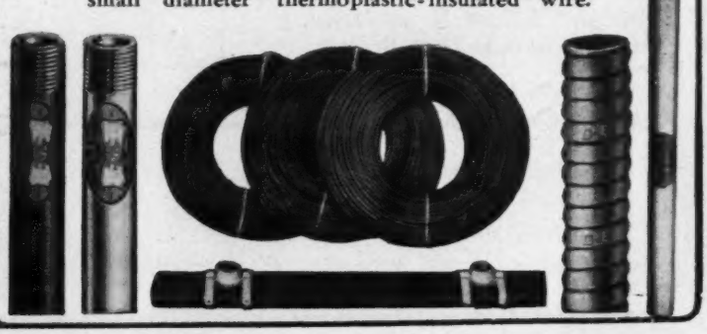


G-E wiring devices are available for all kinds of war-project wiring needs — for maintenance, rewiring or new wiring. The G-E line includes switches, outlets, lampholders, twist-lock devices, connectors, connector bodies, caps, fuses, fluorescent lampholders and starters, etc. These devices are high quality and will give long service.

FOR FURTHER INFORMATION about G-E fuses, industrial wiring devices, conduits or wires and cables, see the nearest G-E Merchandise Distributor or write to Section CDW-746-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

G-E CONDUITS AND BUILDING WIRES

G-E conduits and building wires will meet every requirement. In the G-E line are White and Black rigid conduits, EMT, flexible conduit, Fiberduct and various building wires including Type SN small diameter thermoplastic-insulated wire.

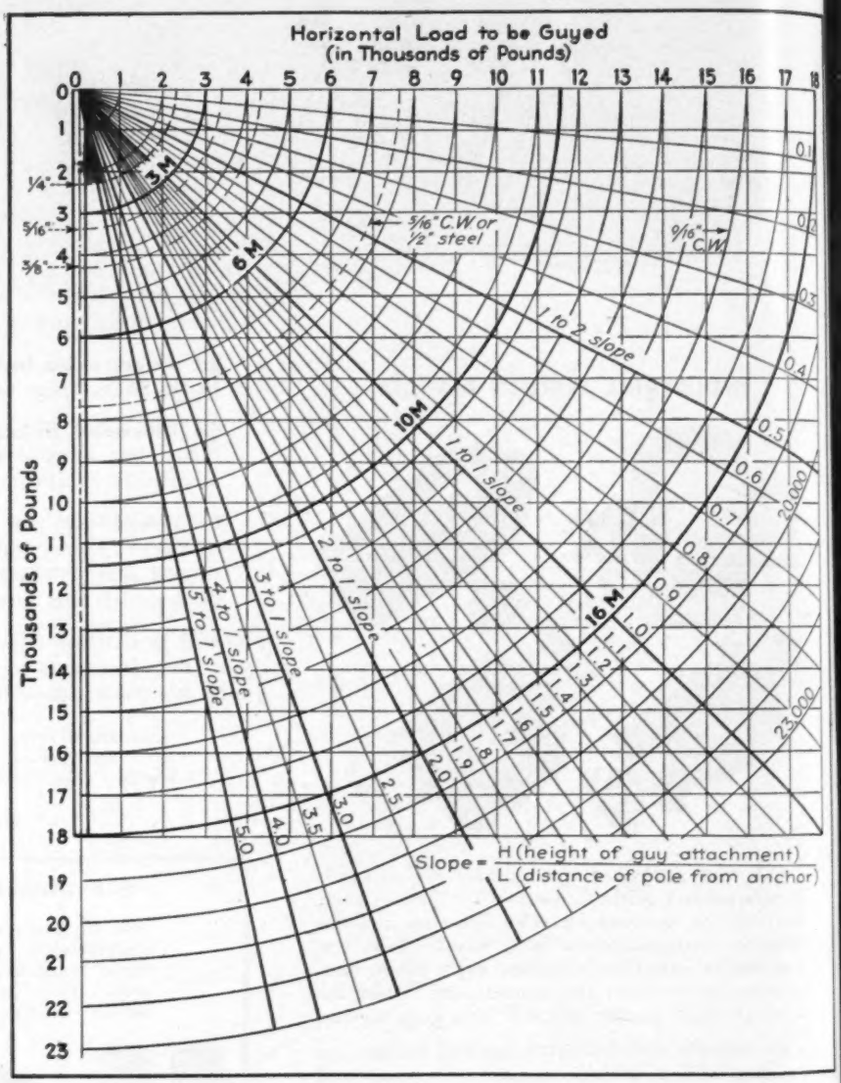


GENERAL ELECTRIC

CHART DETERMINES PROPER GUY SIZES*

The chart was designed by Detroit Edison engineers for field use in determining the size of guy necessary for a given wire load on the pole, taking account of the slope of the guy.

The safety factor necessary is introduced into the load so that the chart reads directly the size of guy. The ordinary standard 3M, 6M, 10M and 16M guy strand are shown by areas on the chart (any load falling between 6M and 10M will take a 10M guy); broken lines are also added for certain sizes of Copperweld (CW) and for some sizes of mild steel guy still in use on the system, designated by diameter.



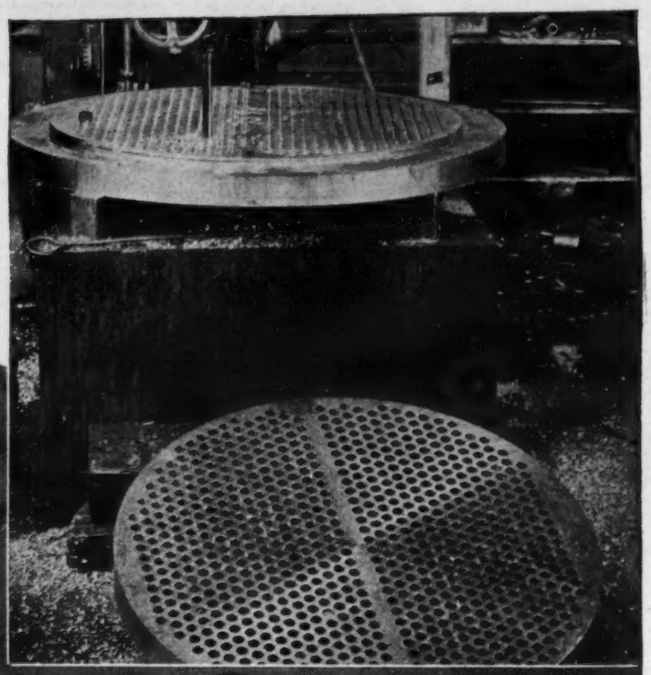
Instructions for Use of Chart

1. Find load to be guyed on top scale (actual load x safety factor)
2. Proceed vertically to line for slope of guy. Area in which this point lies indicates the proper size of guy
3. Find tension in guy wire by following circle
4. Find the vertical component of the load by following a horizontal line to the scale on the left

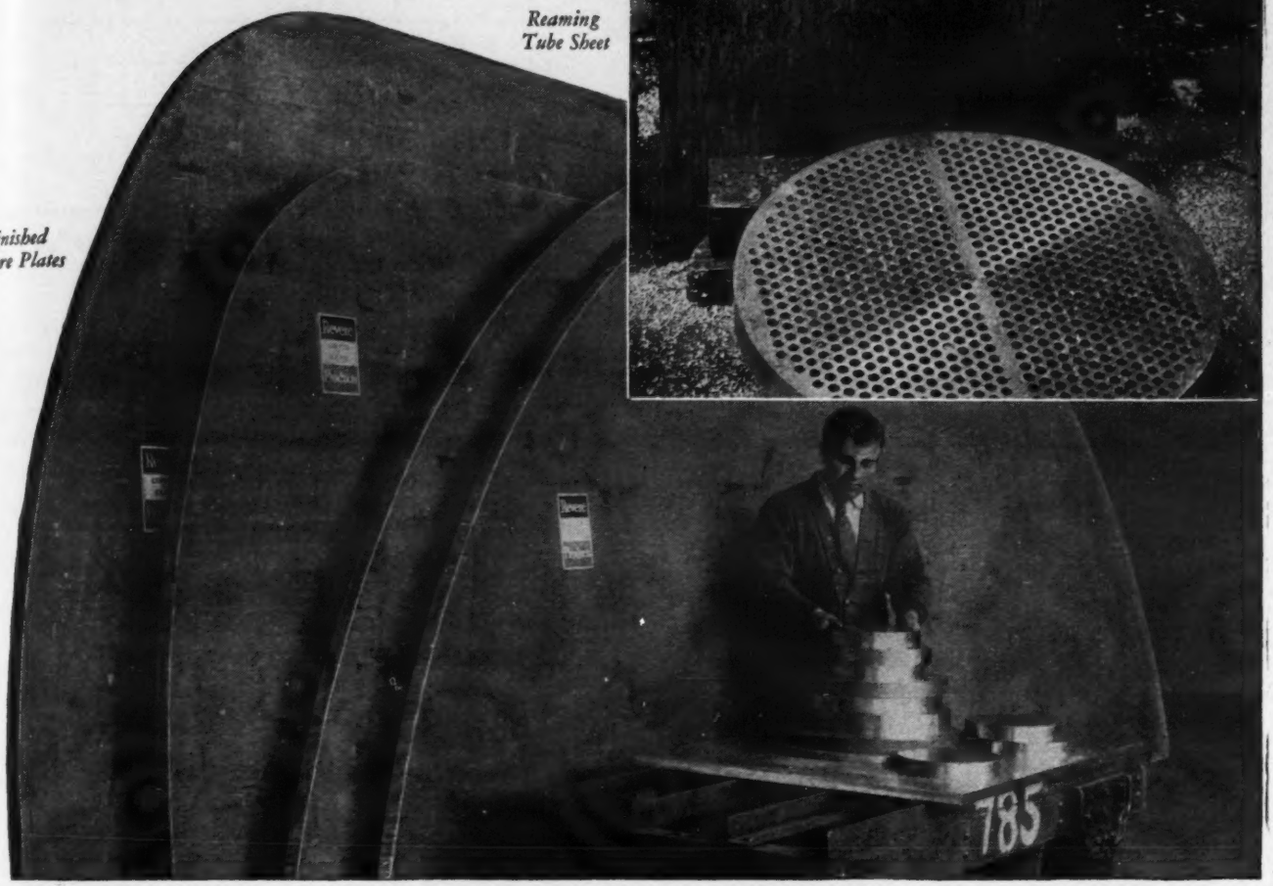
Example: Total wire load 10,000 lb., safety factor 1, slope of guy 1.5 to 1. Use 16M guy. Tension in guy 17,000 lb.; vertical component 13,800 lb.

* All rights to reproduction of this chart are reserved by Detroit Edison Co.

Condenser Tube Plates by REVERE



Reaming Tube Sheet



Finished Revere Plates

JUST as Revere Condenser Tubes are preferred in thousands of power plants because of their long, satisfactory service, so are Revere Plates. The two make a perfect combination, both being made with the same high skill, to the same standards. Revere Plates are produced by hot-rolling "cakes" after machining the original casting to produce a perfect surface.

Revere's long experience makes it possible to deliver to you plates that are dense, free from blow holes and surface imperfections, characterized by flatness, accuracy of gauge, resistance to corrosion, and machinability.

Revere Condenser Tube Plates are available in squares, rectangles, circles, half-circles, segments, patterns, up to 120 inches. Plates may be obtained having a finished weight up to approximately 11,000 pounds. Muntz Metal is commonly used in steam condensers for generating plants. For special conditions of use Revere also makes plates and sheets of Naval Brass, Cupro-Nickel, Admiralty Metal, Copper, Herculoy, Manganese Bronze. For advice in selection of the proper alloys for condenser tubes and plates, write Revere.

Restrictions Lifted!

"Restrictions on the use of some copper base alloys that have limited the inclusion of these metals in the manufacture of tube and tube sheets of steam condensers, have been lifted, the War Production Board announced . . .

"This action will lengthen the average useful life of condenser tubes and sheets, according to WPB, and to a large extent eliminate costly shut-downs of installations using this type of equipment resulting from failure of parts made with substitutes . . .

"The use of copper will also reduce the quantities of replacement and maintenance parts made necessary by the unsatisfactory performance of alternate materials."

—News Release from Office of War Information

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York 17, N. Y.

Three-Wire Primaries Double Loading

By E. A. STANGER
Distribution Engineer, Southern Canada Power Company, Ltd., Montreal

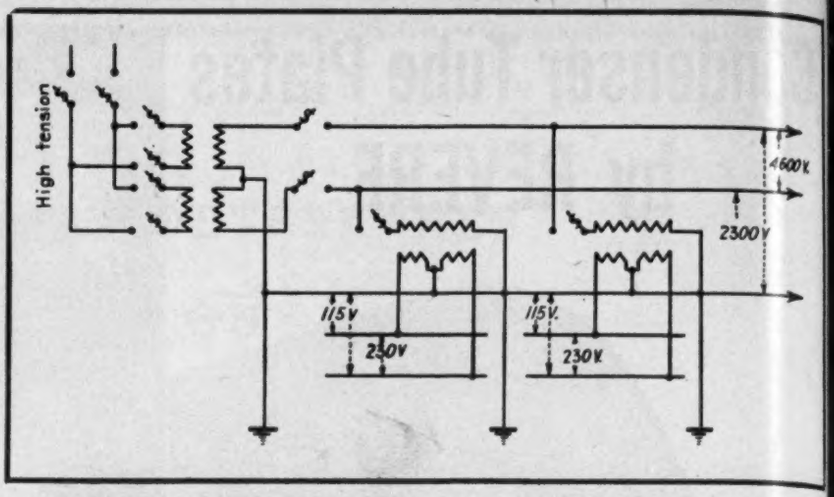
Three-wire single-phase primaries for overloaded rural lines have many advantages in these war restricted times as a solution for this condition. Capacity is doubled, existing transformers are used, half the protective equipment can be recovered. It is a first step to four-wire 3-phase distribution in the future. Usually only half the customers are involved in case of trouble. The influence on telephone parallels is low.

Nearly two years experience with this type of circuit has shown that it is a satisfactory solution in those cases where it is not economic to convert to three-phase operation. A typical example of its use is as follows.

A single-phase tap from a transmission line had been run to a substation at Village "A"; subsequently Village "B", six miles away, was served from this same substation by a single-phase 2,300-volt feeder. Over a period of years before the war a number of farms were connected between the two villages, involving secondary runs in many cases.

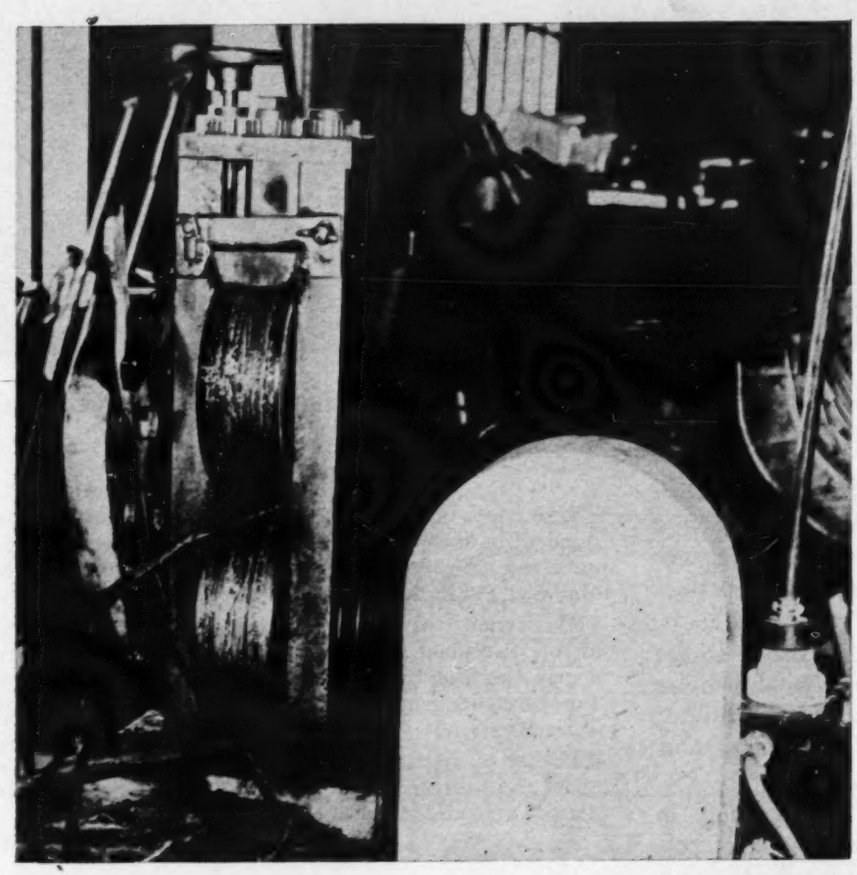
Rapid load increase due to war needs in this milk-producing area overloaded the line. Its capacity was doubled by: (1) Filling in the gaps in the secondary neutral; (2) replacing the single stepdown transformer at the substation by two smaller transformers connected in parallel on the H.T. side and in series on the L.T. side. The common point of the L.T. windings was grounded and connected to the secondary neutral and the outer ends connected to the single-phase primary wires; (3) the service transformers were reconnected from phase wires to neutral and one cutout recovered from each installation, taking care to keep a running balance between the two primary wires and neutral as on any three-wire secondary.

These connections are shown in the diagram. Ultimately this system will become a three-phase, four-wire, common-neutral one, when the load warrants it.



HIGH-TENSION TRANSFORMERS provide 3-wire 4600/2300 primary, saves copper and protective equipment on the 3-wire, single-phase circuit

Rollers Used to Strip Insulation



Power driven rollers, preset for size of the bare wire, are used by the Washington Water Power Co. to strip the insulation from weatherproof wire preparatory to electrically welding, electrically annealing and redrawing copper wire. Operation is part of this company's salvage campaign patriotically carried on to assist in the war effort.

Precautions to Avoid Galvanic Corrosion

Contact or connection of dissimilar metals in a corrosive liquid, accompanied by generation of electric current, causes an action which is electrochemical in nature and is known as galvanic corrosion. Such corrosive

IT'S WHAT WE DO NOT DO . . .

THAT MAKES THE L-M ROUND-WOUND A BETTER TRANSFORMER . . . THE WOUND CORE IS LITERALLY "UNTOUCHED BY HUMAN HANDS!"

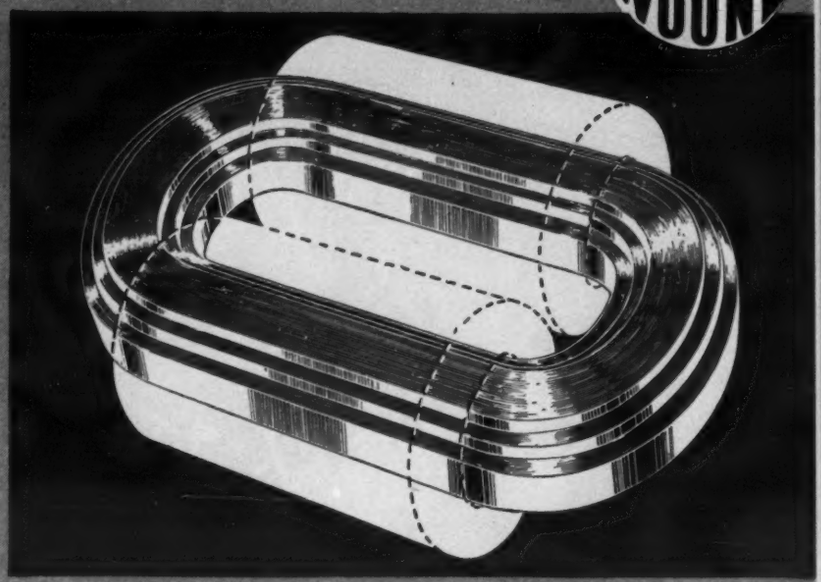
ROUND WOUND COILS CORE

Every engineer knows the basic fundamentals that govern good transformer performance. Therefore it is unnecessary for us to make elaborate claims. We prefer to let the design and construction of the L-M Round-Wound Transformer speak for themselves.

Distribution engineers are familiar with the fact that ultimate results are only attainable by adhering to correct basic principles. They know that air gaps in a core cause high exciting current; that a long coil is better than a short coil; that a round coil is better than a rectangular coil.

The first step in the design of a good transformer is a good core, one made of the correct material properly annealed with no disturbance of the material after annealing.

At the right we give you the highlights in the design and manufacture of an ideal core —the L-M Round-Wound Core. Its practical advantages need no elucidation. Every distribution engineer will recognize them at a glance. It's the things that we do NOT do that prove so important in L-M Round-Wound Transformer performance.



The core is NOT stacked. It is wound under tension and clamped under pressure. The result: practically no air gap with consequent lower exciting current. In some sizes this reduction is as much as 50%.

The core is NOT rectangular. It has no wasteful corner sections. Core strips of silicon steel are wound "with the grain" in an elliptical shape, closely approaching the perfect magnetic flux movement—100% "downstream."

The core is NOT relaminated, unwound for rewinding or cut into sections after annealing. As a result characteristics remain stable.

Core and coils are NOT assembled backwards. L-M round coils are wound directly onto the core. The core is not rewound or cut and fitted to the coils. Therefore there is no need for disturbing the core after annealing.

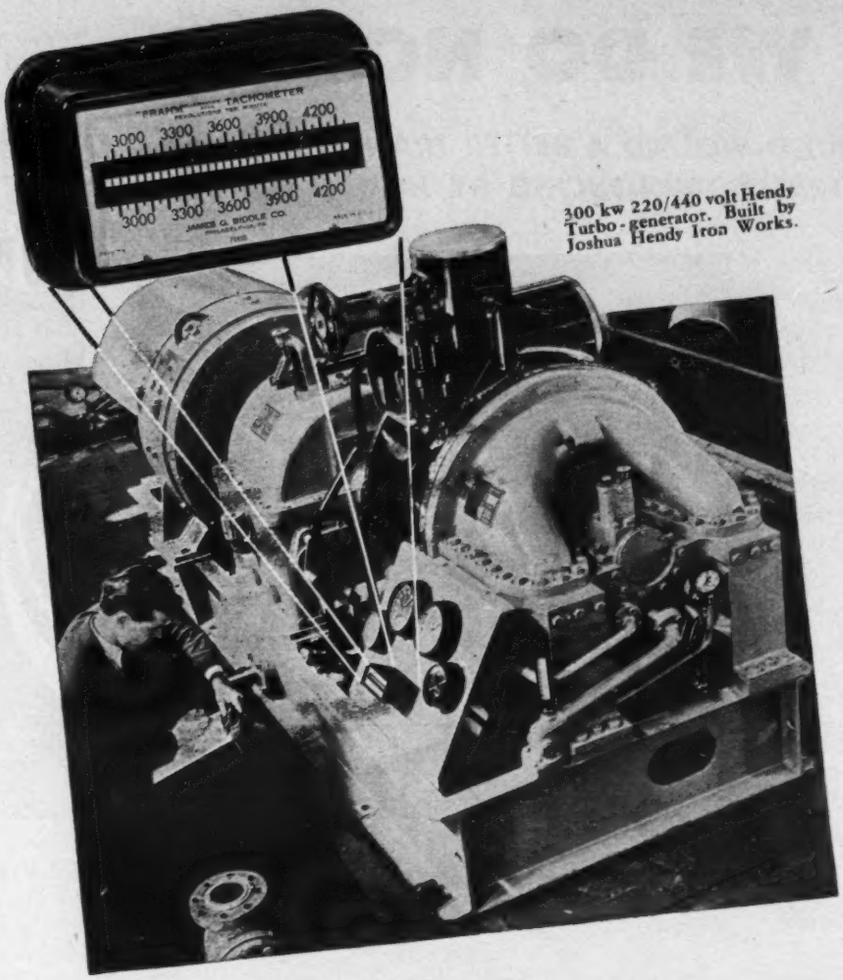
The cross section of the core is NOT square. Successive varying widths of strip steel are mechanically joined together and are wound so that the cross section is of a cruciform shape—a shape approximating a round cross section. The half slots so provided, act as channels between the core and the coils, permitting free, easy circulation of the cooling oil. Inherently low temperatures naturally result.

L-M Round-Wound Transformers are available in 1½ to 25 Kva, 2400 to 7620 volt ratings and are built in complete accord with EEI and NEMA distribution transformer standards. A very detailed description of these transformers will be found in Bulletin RW-421. You can secure a copy from your nearest Line Material sales office, or by writing direct to the Line Material Company, Milwaukee, Wisconsin.

LM

LINE MATERIAL
TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters
Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment



300 kw 220/440 volt Hendy Turbo-generator. Built by Joshua Hendy Iron Works.

. . . making "ASSURANCE DOUBLY SURE" with the "FRAHM" RESONANT-REED TACHOMETER

In the modern turbo-generator, uniformity of speed must be maintained over the entire range of no-load to overload conditions.

The Hendy unit shown above has a carefully designed and precisely built governor to assure uniform speed under widely varying load conditions. As a double check, however, Frahm Resonant Reed Tachometers are used on Hendy and other well-known turbo-generators, both large and small, to provide the operator with constant proof of turbine speed. Manufacturers select Frahm instruments for this service because of their simplicity of construction, ease of installation and freedom from maintenance.

Frahm Tachometers are built in both stationary and portable types for use on many kinds of machines having rotating parts. Various ranges are available from 900 to 60,000 r.p.m.

For a complete description of Frahm Tachometers together with list of types and ranges commonly supplied, write for Bulletin 1590-W.

JAMES G. BIDDLE CO. 1211-13 ARCH ST. PHILADELPHIA 7, PA.

action may be kept within bounds or even turned to advantage by observing specific precautions, according to the current issue of Inco (International Nickel Co., New York).

A guide to the direction of galvanic action is given in an accompanying table showing the order of galvanic relationships of the various metals. The farther apart the metals stand in the series, the greater will be the galvanic tendency. Metal nearer the top

Position of Metals in the Galvanic Series

Corroded End (anodic, or least noble)

- Magnesium
- Magnesium alloys
- Zinc
- Aluminum 2S
- Cadmium
- Aluminum 17ST
- Steel or Iron
- Cast Iron
- Chromium-Iron (active)
- Ni-Resist
- 18–8 Stainless (active)
- 18–8–3 Stainless (active)
- Lead-tin solders
- Lead
- Tin
- Nickel (active)
- Inconel (active)
- Brasses
- Copper
- Bronzes
- Copper-nickel alloys
- Monel
- Silver solder
- Nickel (passive)
- Inconel (passive)
- Chromium-iron (passive)
- 18–8 Stainless (passive)
- 18–8–3 Stainless (passive)
- Silver
- Graphite
- Gold
- Platinum

Protected End (cathodic, or most noble)

of the list will suffer accelerated attack and metal nearer the bottom will be protected. Metals within a group may usually be combined. But even here it is necessary to avoid combinations where the exposed area of the higher metal is much less than that of the one lower in the group.

A basis for controlling the extent of galvanic action is provided in the following outline of precautions.

1. Select combinations of metals as close together as possible in the galvanic series.

2. Avoid combinations where the area of the less noble material is relatively small. It is good practice to

STURD-E GUARDED

PIKE POLE

●The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.

The spike is forged from best quality steel, heat treated and tempered for long life. Handles are select fir—sanded and lacquered—lengths regularly furnished ten to twenty feet. For maximum service life, economy, and value, specify

STURD-E-TOOLS
a TRUE TEMPER PRODUCT

Automatic Tubular Pike Pole guard is shown in the phantom view above. Extremely simple in operation, it gives positive protection to the point of the pike.

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Need Another

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Right now "American" can furnish a limited number of Utility Bodies of the following types:—

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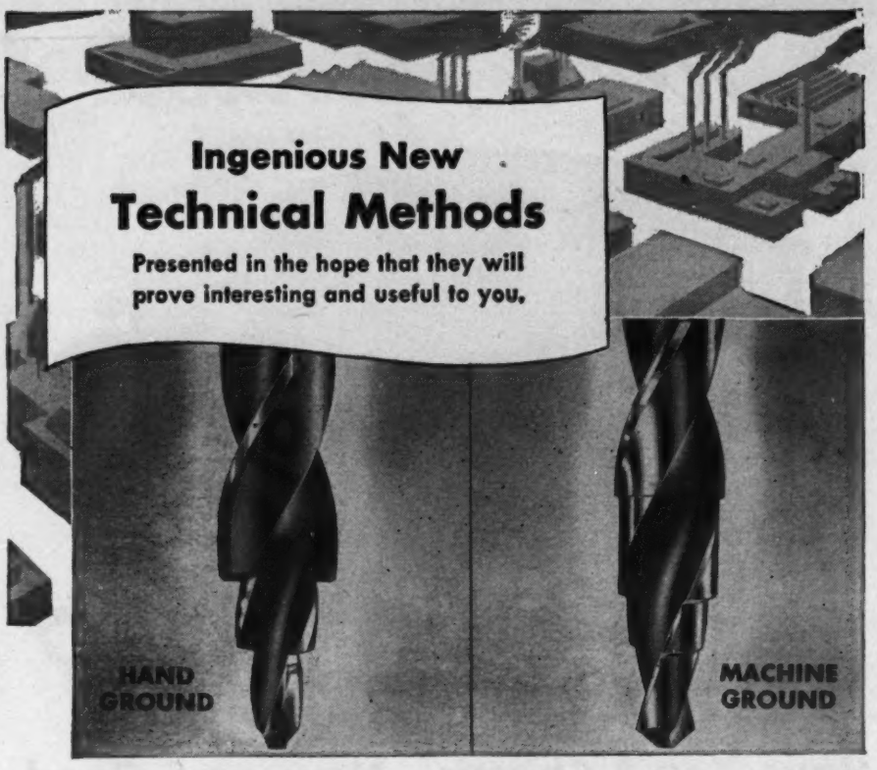
- Service and Meter Bodies (Model 4460)
- Street Light Patrol Bodies (Model 4671)
- Telephone Rural Installation and Maintenance Bodies (Model 4551)
- Revolving Aerial Ladders (Model 4644)
- General Utility Compartments (Model 4804)

Today, with the tremendous pressure on the construction and maintenance crews, many utilities are in need of equipment of the character of American Utility Bodies, that will save time and labor, increase efficiency and ease considerably the strain caused by manpower shortage.

"American", appreciating this emergency and desirous of assisting to the utmost, has set up a schedule that will permit the construction of a limited number of a limited type of Bodies. So if you have available a chassis, new or old, phone, wire, or write today for complete details.

Some Reasons Why "Americans" Are TOPS:—
Correct Design • Superior Quality Construction • Comfort • Convenience • Safety • Endurance • Low Operating Cost • Fine Appearance

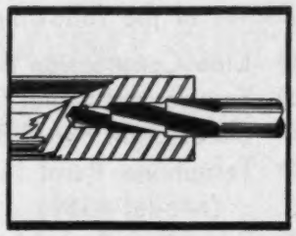
THE *American* COACH & BODY CO.
PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES


Ingenious New
Technical Methods
Presented in the hope that they will prove interesting and useful to you.
HAND GROUND
MACHINE GROUND

New Precision Step Drill Grinder Simplifies Production and Maintenance of Step Drills

The quality of a step drill produced by common methods depends almost entirely on the skill and attention of the individual tool maker. However, with the development of the precision step drill grinder, the human element has been entirely eliminated, the characteristics of the step being completely controlled by the grinding machine without adjustments during the course of grinding. This automatic feature insures absolute uniformity, regardless of quantity, and permits large-volume production of step drills.

The apparent advantages gained through the use of the step drill grinder are: Permits mass production of drills ground to exact specifications, entirely independent of the human element. Maintenance, too, is no longer an obstacle as step drills produced by this method are quickly sharpened by the same uniform machine-controlled operation. With the step drill grinder step drills can now be made from standard drills. These advantages result in a wider application of step drills which provide a definite saving of machine tools, man-hours and cost; this in turn results in greater production.



The above illustration shows mechanical design which requires a hole having diameters diminishing in steps. This is an operation for step drills which has often been neglected due to difficulty in obtaining and maintaining step drills.

Step drills produced by our method are quickly sharpened by the same uniform, machine-controlled method.

You know there are plenty of benefits in chewing gum, too. That's why all of the Wrigley's Spearmint we're able to make from our available stocks is going overseas to our fighting men and women. You know what a lift it's been on the job and we wish we could supply everybody, because we have pride, too, in our workmanship and productivity. But there just aren't enough available top quality raw materials right now to do it. When we can produce it in sufficient quantity, it will be back to you with the same fine flavor and chewing satisfaction . . . Wrigley's Spearmint has never been changed!

You can get complete information from Spiral Mfg. Corp., 5022 North Kedzie Avenue, Chicago 25, Illinois.

Y-127

use the more noble metals for fastenings or other parts in equipment built largely of less noble and less corrosion resistant material.

3. Insulate dissimilar metals wherever practical. If complete insulation cannot be achieved, anything such as paint or plastic coatings at joints to increase the resistance of the circuit will help.

4. Apply coatings with caution. For example, when painting—do not paint the less noble material without also coating the more noble, otherwise greatly accelerated attack may be concentrated at imperfections in coatings on the less noble metal. Keep such coatings in good repair.

5. Prevent or limit aeration of the corrosive liquid as much as possible to sustain the polarizing effect of the hydrogen film which forms on bare cathode surfaces.

6. If practical, add an appropriate chemical inhibitor to the corrosive solution.

7. Avoid using threaded connections to join metals well apart in the series, as the threads will probably deteriorate excessively. Brazed or welded joints are preferred.

8. Whenever possible, install relatively small replaceable sections of the less noble material at joints and increase the thickness of the less noble material in such regions; for example, by using extra heavy wall nipples in piping or by attaching replaceable pads to critical surfaces.

9. Install pieces of bare zinc or steel to provide a counteracting effect to suppress the unwanted galvanic corrosion.

•

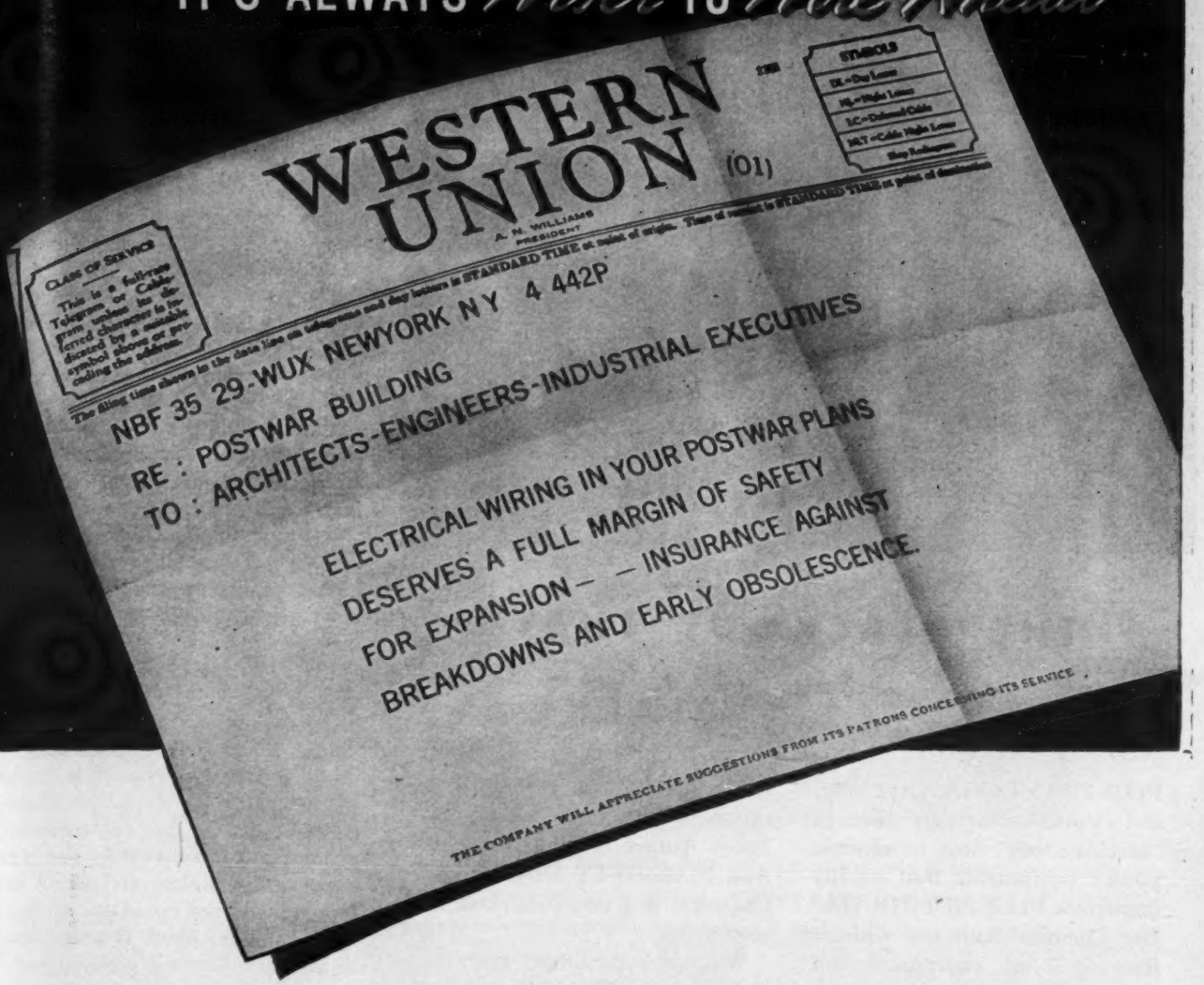
Relay For Air-Cooled Type Transformers

By E. W. TIPTON
Transformer Engineer, Westinghouse Electric & Manufacturing Co., Sharon, Pa.

By the development of a bimetallic relay, loading of air-cooled transformers can be controlled on the basis of both time and temperature. The design utilizes two bimetal elements which are actuated by changes in air stream temperature and transformer current, and at fixed temperatures each closes a low-energy switch.

The relay permits the safe utilization of the short-time overload capacity of air-cooled transformers and protects the transformers from dam-

IT'S ALWAYS *Wiser* TO *Wire Ahead*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PLANNING POSTWAR HOMES? A new factory? A brighter, more bustling town? You'll want to take every advantage of the wonderful electrical devices of tomorrow.

So—Wire ahead! Make sure that your electrical system can handle the greatly increased load that it will surely be asked to carry.

While you're in the advanced planning stage consult with your engineer, electrical contractor and utility power engineer. Unwired planning will cost you a lot more than planned wiring. 44343

HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS

ADEQUATE WIRING KEY TO VICTORY JOBS. SERVES AND SAVES

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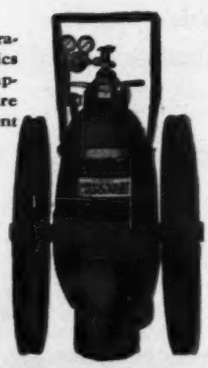
CHART showing comparative characteristics of all types of approved hand fire extinguishers, sent free on request.



MODEL 150 WHEELED EXTINGUISHER

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN
OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

age by short-circuit currents. On transformers designed for forced cooling the relay can be connected to start the fans when the winding reaches a predetermined temperature.

One bimetal element is set to operate at a time when the transformer winding approaches a safe temperature limit. It closes an auxiliary relay on a control panel which lights a signal lamp and locks in. The signal lamp burns until the operator resets the relay. This assures that a record of the overload will be maintained even though the load drops to normal in the absence of an operator.

The second bimetal element operates when the transformer reaches a safe temperature limit. It also closes an auxiliary relay on the control panel. A circuit on the auxiliary relay is carried to a terminal block and is designed for connection into the control circuit of the main circuit breaker so that it will remove the load from the transformer before the winding is damaged. The auxiliary relay in this circuit may be operated either to seal in or non-sealing at the option of the operator.

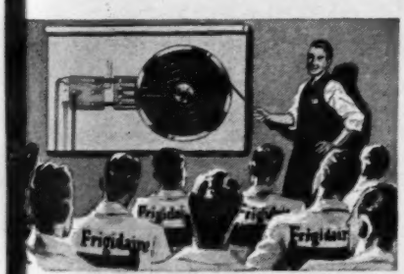
Protects Transformer

This relay known as type TRA has design principles used in the relay for oil-filled transformers. It is located in the hottest air from the winding cooling ducts so that one component of the bimetal temperature rise is the same as the cooling air rise. A current transformer circulates a current in the bimetal which is proportional to the load. Bimetals are designed so that this current produces a temperature gradient to the hot air which is proportional to the gradient from winding hottest spot to hot air. Bimetal temperature is thus made to be proportional to winding hot spot temperature regardless of the loading cycle. Calibrating screws permit independent settings of the two switches to close at any desired value of winding hot spot temperature.

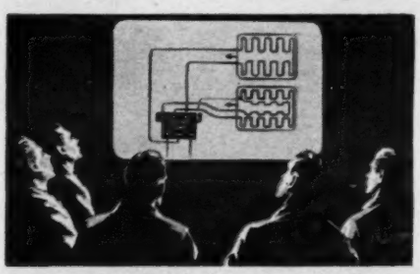
For overloads of the magnitude of short circuits the bimetal will operate instantly because of the heating effect of the load current alone and will not lag because of the time required for the air temperature to rise. This characteristic makes it possible for the relay to protect against short circuit damage. Current transformers used with the relay are designed not to saturate for currents less than ten times normal.

Range Service Training Helps Frigidaire Dealers Build For The Future

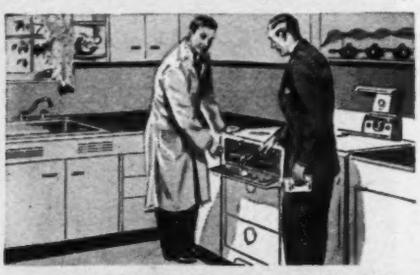
This 88-page POCKET-SIZE Guide*—profusely illustrated—provides the range serviceman with complete reference data to take on the job with him.



rvice Schools, conducted by factory and strict personnel, give complete training on rvicing Frigidaire Ranges.



New Slide Film teaches "mechanics" of range servicing and the "important trifles" of range operation from housewife's viewpoint.



Factory and District Range Service Specialists provide valuable field help and guidance for Frigidaire service personnel.

This complete Training Program is enabling Frigidaire Dealers to provide effective Range Service in the face of acute manpower shortages and other wartime problems. The resulting backlog of good will among users of Frigidaire Electric Ranges will be reflected in new and greater sales opportunities for Frigidaire Dealers in the great peacetime future that lies ahead.

*This New Reference Guide is extremely popular among Frigidaire Range Servicemen. Although small enough to be carried in the pocket—it is so complete, with many of the diagrams and illustrations produced in full color—that even experienced range servicemen find it a valuable help when called upon to service Frigidaire Ranges.

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LOAD SERVICING

Commercial
Industrial

Residential
Rural

Progress Report* on Post-War Load Survey

Compilation of data from a survey of post-war loads now being made by the Philadelphia Electric Co. shows the following information in reference to industrial customers. The data covers only 381 customers.

Of these, 182 (47.8 percent) will install additional or replacement lighting.

Additions to load in electric heating will be made by 106 (27.9 percent), in ventilation by 75 (19.7 percent), in air conditioning by 33 (8.7 percent) and in refrigeration by 7 (1.8 percent).

Additional or replacement machines will be installed by 71 (18.6 percent) and 46 (12.7 percent) plan on changes that include increased power requirements.

Increased production is envisaged by 38 (10 percent) and 30 (7.9 percent) will add to space by constructing new buildings or expanding into others.

* From a paper by J. F. Gaskill to Missouri Valley Electric Association. Second of a series beginning in June 24, 1944 issue of Electrical World.

•

Electric Brazing Reduces Rejects

Selective copper brazing of an ordnance part on a high production basis in electric furnaces and without the high scrap percentage of conventional brazing methods has been developed at the Industrial Steel Treating Co. of Jackson, Mich., and is in production there.

The process employs electric salt bath furnaces and not only permits the selective heating of the parts to be brazed, but also eliminates decarburization, and has reduced scrap from 15 percent to a maximum of 1 percent as compared with conventional methods. The salt bath furnace method has also reduced distortion so that the amount of time and cost involved in straightening brazed work has become negligible. As a result, what was once considered a difficult, "tricky" job has now taken its place as a simple, foolproof production heat treating operation with results that are completely predictable.

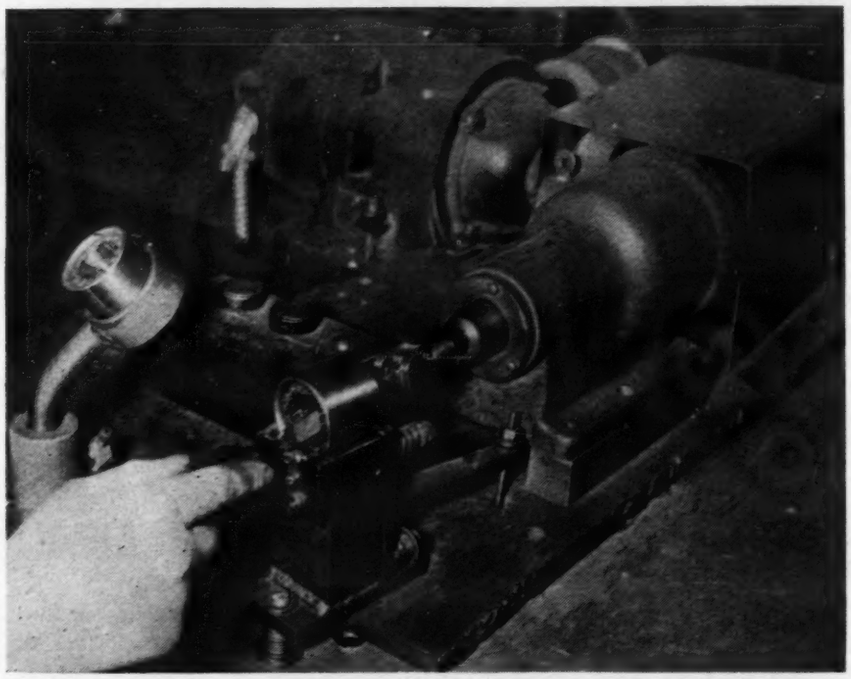
Operation and Control

The operation consists of copper brazing two small cheek plates to a length of 1050 steel. Three standard electrically heated salt bath furnaces are employed: preheat, high heat and quench. The temperatures of the furnaces are controlled automatically to close limits with special timing controls. The control for the high heat holds the temperature of the furnace at a constant level until work is to be treated. Then, a special heat measuring control on the instrument panel permits the operator to add exactly the required amount of heat for the exact pre-determined time. Thus, the operation is entirely automatic with temperatures and time being fully controlled.

The time that the work remains in the high heat furnace and the temperature at which the furnace is held are both important. The temperature is held at exactly 2,090 deg. F. and the time is exactly ¾ minutes. The salt quench is one of the reasons for the outstanding success of the entire process. This checks the flow of copper immediately. It eliminates the tendency of the copper to run or blow or form a blob on the surface of the work. The work comes out of the quench clean and smooth excepting for a thin and unimportant coating of salt. Temperature of the quench usually held at 1,150 deg. F. is not critical.

Production speeds of brazing by this process, which employs Upton Electric salt bath furnaces with hea

Machine Eliminates Hand Filing



TAILSTOCK assembly from a winding machine, small motor, speed reducer, holding fixture and a file are the component parts of a filing machine devised by Joseph Geenens, assistant general foreman, General Electric, to remove burrs and irregularities in the slots of stators of instrument type motors in order to facilitate winding

MORE *Work* LESS *Manpower*
···DEMANDS MORE *Truck-Power!*

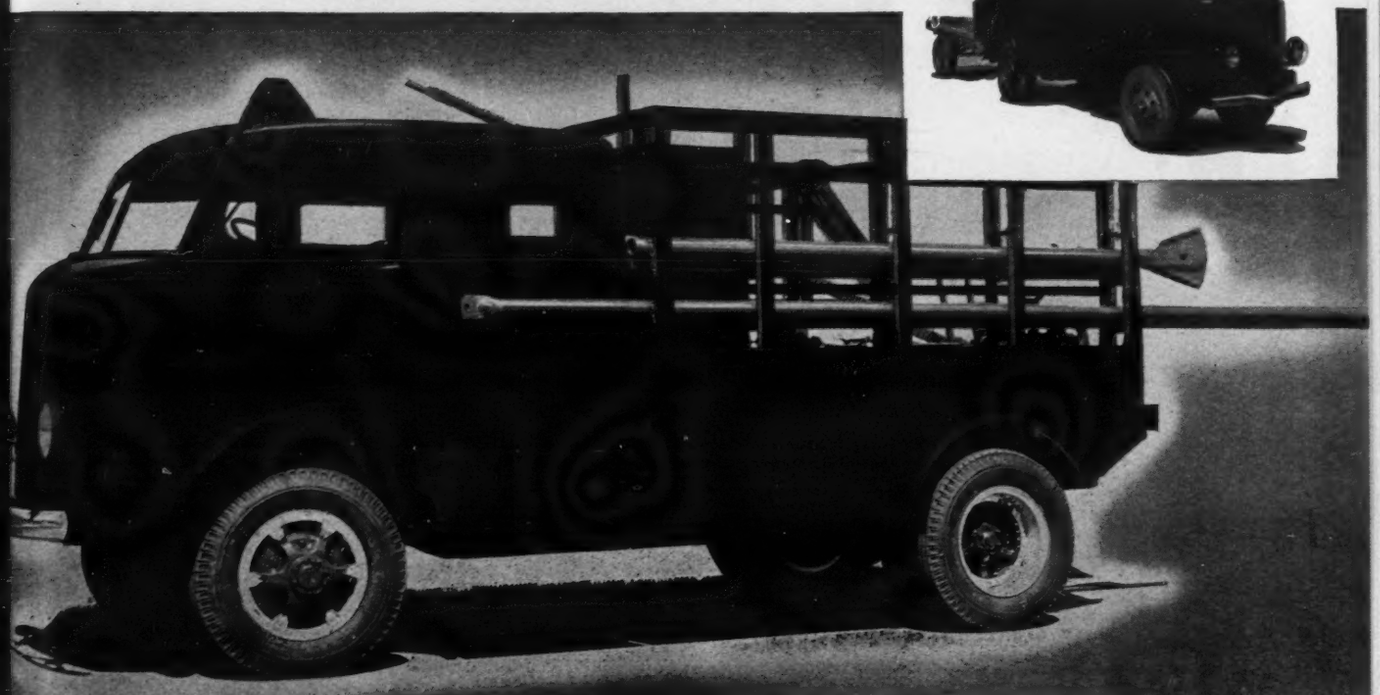
This is it: FWD means more truck-power . . . the answer to the utility problem of increased service from decreased manpower.

FWDs are engineered for public utility service . . . special power take-offs for winch and boring work are part of the basic design . . . pole derrick, splicer's cart, cable-laying, plows and other practical line-construction and maintenance accessories increase the usefulness of these trucks.

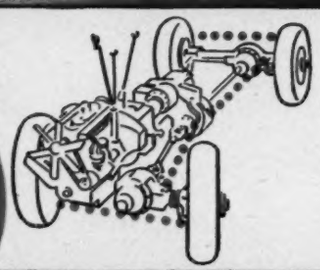
On or off the highway, in any weather, over any terrain, FWDs go in with drive in all four wheels to do whatever the emergency calls for . . . making up for much of the manpower shortage with greater truck efficiency. They are first choice of more than 150 utility companies operating big fleets.

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONT.

The Oldest and Original Exclusive Builders of Four-Wheel-Drive Trucks



FWD TRUCKS



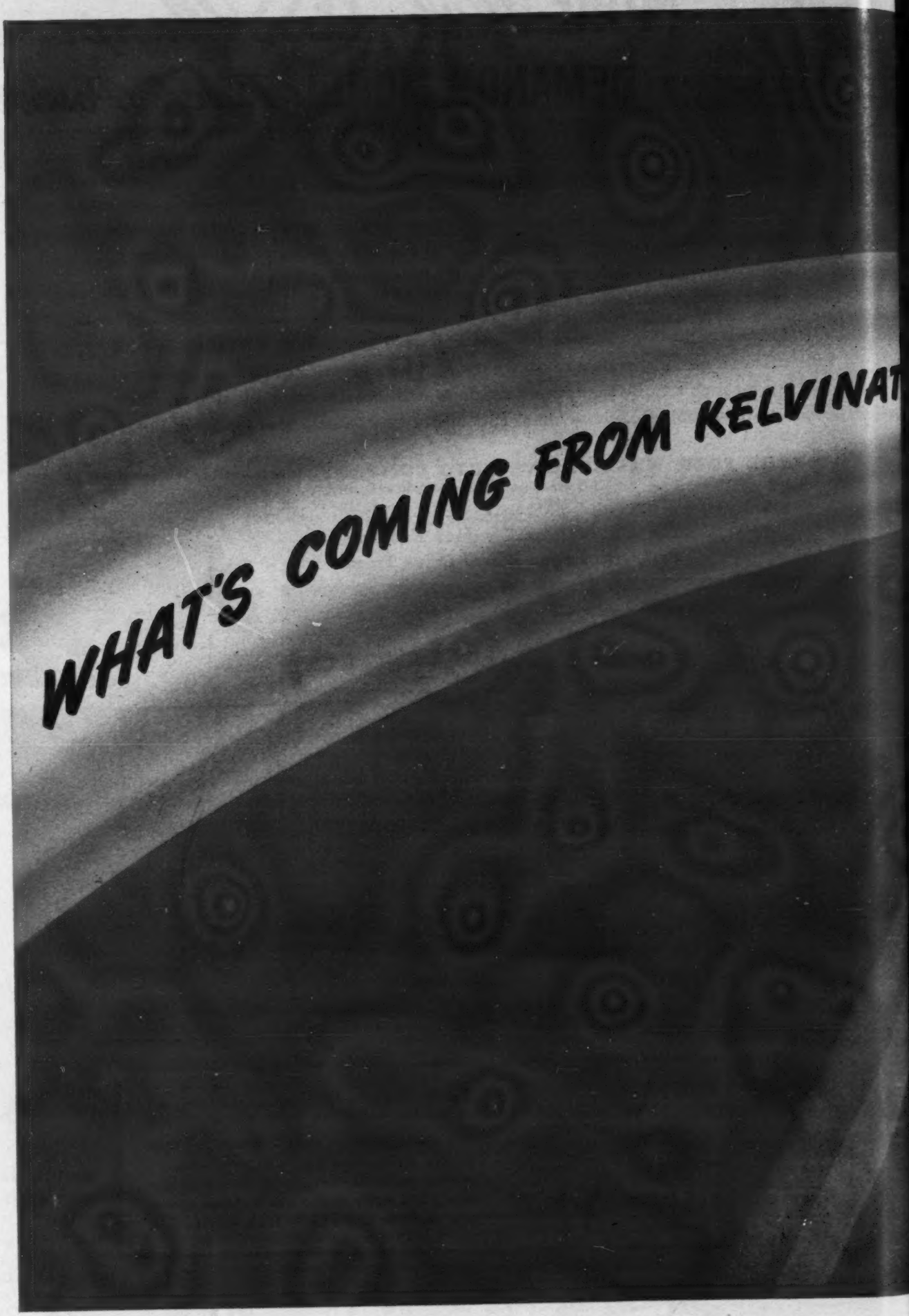
Four-Wheel-Drive... THE BACKBONE OF RUGGED, DEPENDABLE TRUCK HAULING POWER

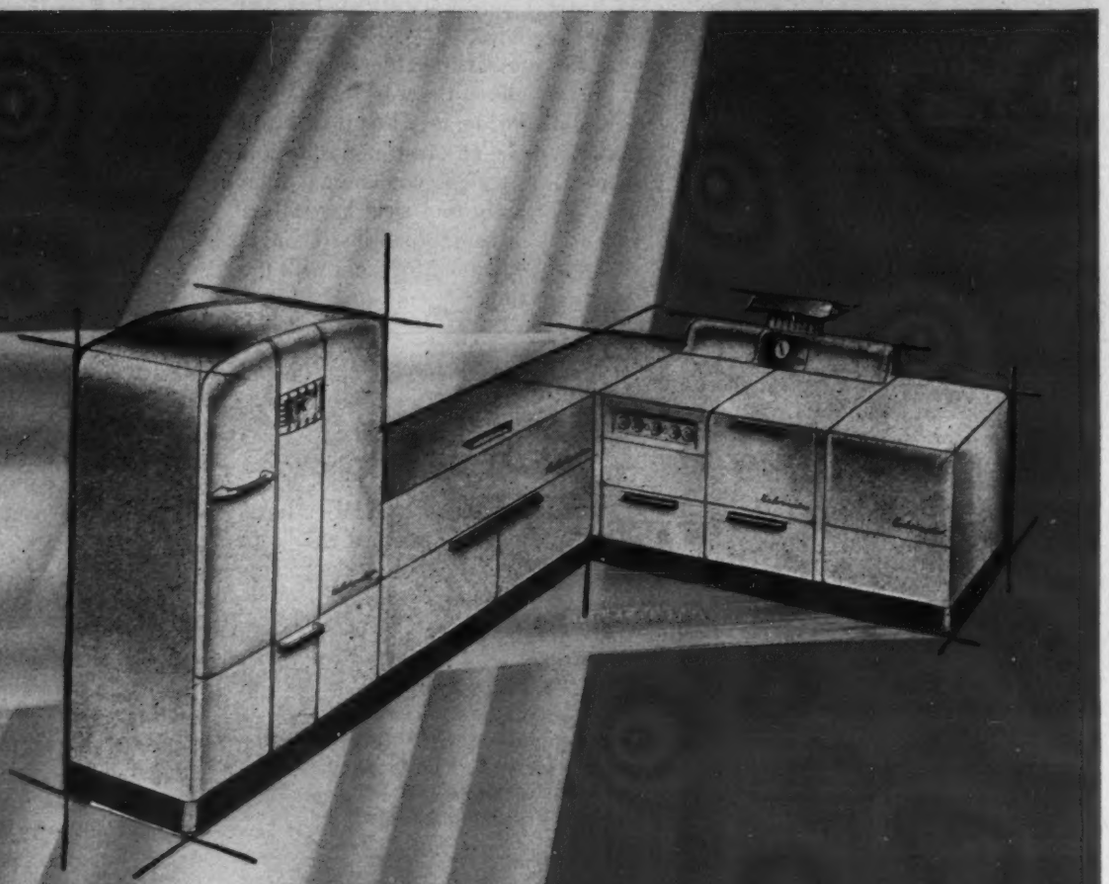
The true application of four-wheel-drive with center differential provides ability to get through under difficult conditions — increased surety and safety on the road — lower operating cost per ton-mile — long service life.

BUY MORE WAR BONDS

IN EVERY FIELD WHERE TRUCK QUALITY IS PUT TO THE TEST, FWD'S STAND UP

COMMERCIAL · CONSTRUCTION · UTILITIES · OIL-FIELDS · MILITARY


WHAT'S COMING FROM KELVINAT



Realizing that electric utilities, generally, face a tremendous task in building up their domestic load in the first postwar years, Kelvinator will offer more than a complete line of Refrigerators, Home Freezers, Electric Ranges and Water Heaters!

Here at Kelvinator we are already at work formulating long-range merchandising plans that will help utilities get these load builders into owners' homes where they will do their part in increasing current consumption on domestic lines.

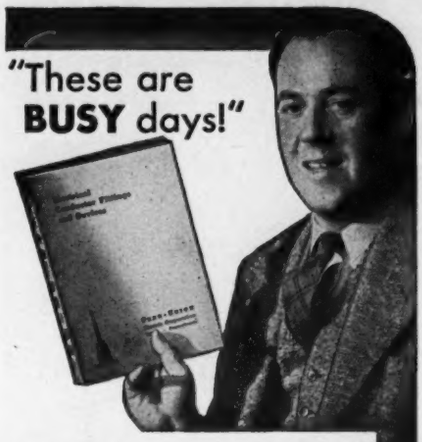
Full details will be announced at the proper time.

OK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

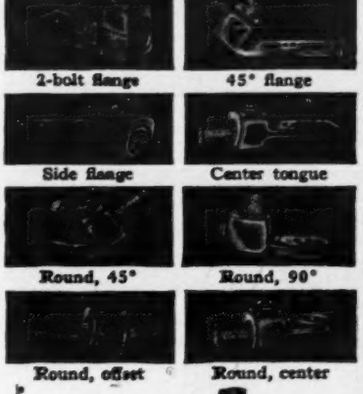
Awarded to Nash-Kelvinator Corporation, Propeller Division



SAVE TIME—select your conductor fittings from this Catalog . . **ALL** good types

You can buy Tee Connectors, Grounding Clamps, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Service Connectors, Bus Supports, Terminals . . . *practically every good type, in the COMPLETE line.*

JUST FOR EXAMPLE— here are some of the standard Penn-Union Vitite terminal lugs:



These types and many more—in a *complete* range of sizes. Write for Catalog.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors. They have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

measuring control is estimated at 600 to 700 per hour.

At the present time, the high speed of brazing allows the work to be completed in considerably less than a full working day. The rest of the time is devoted to straight commercial high speed and moly tool steel hardening. This work is being done interchangeably in the identical furnaces with the copper brazing.

•

Reduction of Street Lamp Breakage

Patriotic appeals to school children apparently have cumulative results in reducing street lamp breakage. This conclusion derives from data supplementing the article, "Talks to Pupils Cut Sling-Shot Sabotage," by C. R. Tracy in the previous (June 10) issue of ELECTRICAL WORLD wherein is described how sling shot sabotage was cut 50 percent. The figures arrived too late for inclusion in the article and are presented here.

RESIDENTIAL STREET LIGHTING LAMPS BROKEN

	1943	1944
February	92	83
March	99	53
April	205	85

STREET LIGHTING ELECTROLIER LAMPS AND GLOBES BROKEN

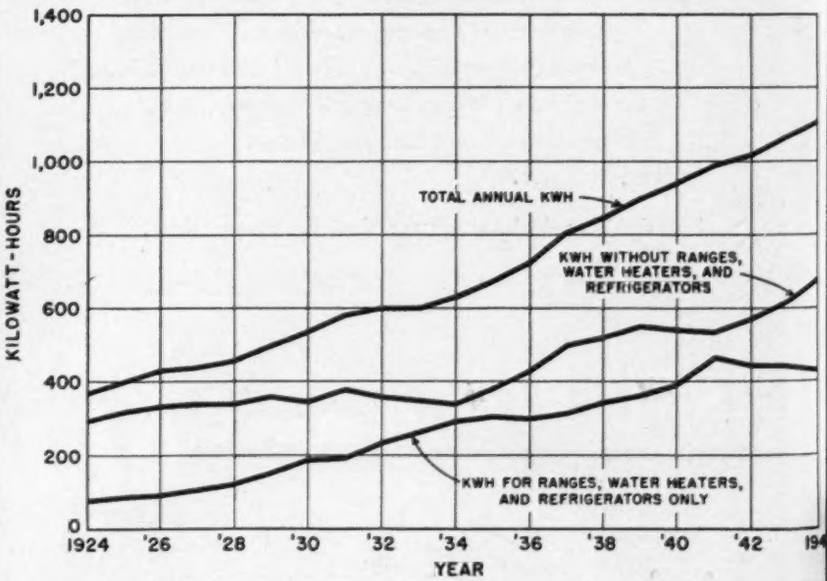
	1943	1944
February	7	2
March	11	3
April	12	2

Large Appliances— Average Annual Kw.-hr.

How effectively the three major appliances—ranges, water heaters and refrigerators—have contributed to domestic electric consumption is shown in the accompanying graph which was included in the paper on reversed refrigeration as a means for space heating by Philip Sporn, vice-president, American Gas & Electric Service Corp., at the recent annual meeting of the Edison Electric Institute. An abstract of this paper was printed in ELECTRICAL WORLD, June 10, 1944, page 99.

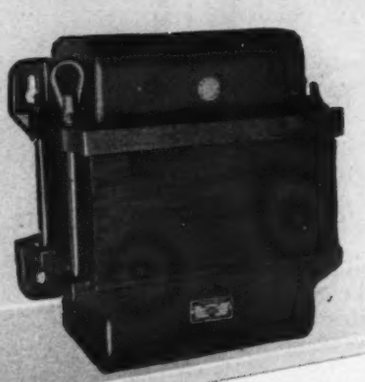
The graph contains three curves, the bottom one representing the three appliances only; the middle, light and all other loads; the top the total of the two lower curves. Thus the area between the middle and top curves shows the contribution of the large appliances to the average annual domestic consumption of energy.

One significance of this graph lies in the comparative saturation factors of the three major appliances for 1944 stated by Mr. Sporn to be ranges, 11.7 percent; water heaters, 3.85; refrigerators, 69. It is to be expected when these appliances return to the market and become again the major elements in utility load building efforts, that the area between the projected top and middle curves of this graph will rapidly widen as the saturation factors of the appliances increase.



EFFECT of electric ranges, water heaters and refrigerators on average annual energy usage per domestic customer, according to recently obtained data and presented to the Edison Electric Institute by Philip Sporn, vice-president, American Gas & Electric Service Corp.

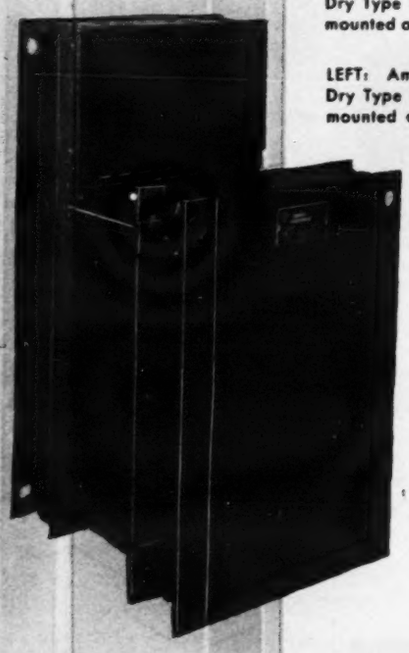
STOP MOTOR STARVATION



WITH AMERTRAN DRY-TYPE TRANSFORMERS AT LOAD CENTERS

ABOVE: AmerTran CF Dry Type Transformer mounted on an I Beam

LEFT: AmerTran WF Dry Type Transformer mounted on pillar



When motor relays kick out, overload is not always the cause. Such motors may be underpowered because long secondary feeders or other load centers have robbed them. Yet these outages can be corrected or forestalled and substantial copper savings effected—by stabilizing load center power distribution with AmerTran Dry-Type Transformers.

No disturbance of existing equipment is necessary. Eye beams or pillars close to the work can furnish mounting because AmerTran Dry-Type Transformers are unusually small and light for their conservative ratings. Comprising both standard and special types, they are available in a wide range of ratings and for many applications. If desired, Class B insulation may be specified. Write today for descriptive literature.

AMERICAN TRANSFORMER CO. 178 Emmet St., Newark 5, N.J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

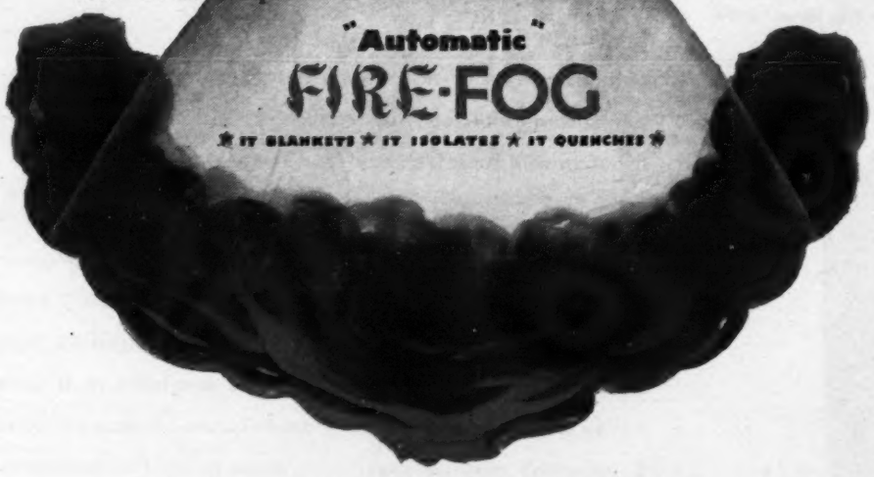
IS TOMORROW TOO LATE -

If Fire Breaks Out Today?

A fire broke out in a plant. It could have been ruinous, but wasn't. It could have spread, but didn't. Although of flammable liquid origin, it didn't have even a fighting chance . . . this *plant was protected by an "Automatic" FIRE-FOG installation.*

What *did* happen? No sooner did the first flames leap up than out of pre-directed FIRE-FOG nozzles "shot" a mist-like cooling spray, attacking and surrounding the flames, cloaking the fire, "squeezing" the oxygen from the air and strangling the blaze.

Only a matter of seconds to quench a fire which, if inadequately controlled, might have proved devastating! *Quick action plus automatic operation* — that's FIRE-FOG, the IDEAL in fire protection.



Isn't *now* the time to determine whether your fire hazard protection is adequate? An "Automatic" engineer will cheerfully furnish complete information about a FIRE-FOG installation—*where* it should be used, *why* it protects, *how* it operates. Write us.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA ★ YOUNGSTOWN, OHIO

★ ★ ★ OFFICES IN PRINCIPAL CITIES ★ ★ ★

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA — RATE OF RISE — TRADE MARK REG. U.S. PAT. OFF.

Man Sits Down Machine Splits Wood

Wood-splitter made mostly of junk parts found around the farm of C. E. Jeerings, Farm Service Supervisor of Rochester Gas and Electric Corp., Rochester, N. Y., makes it possible for one man in one day with little effort to split enough wood for the entire season.

The accompanying picture shows the general construction of the splitter. A one-half-hp., 1,500 r.p.m. elec-

H. V. Rickner Photo

ELECTRICALLY driven wood-splitter

tric motor mounted on a hinged platform and operating at 220 volts supplies the power for the unit. A flat leather belt drives the pulley which in this case is a 42 inch wooden line-shaft type. This pulley is attached to a 1½-inch steel shaft together with three old balance wheels taken from buzz saws. The 1½-inch steel shaft has since proven to be a little too light and has been replaced by a 3-inch shaft. Parts, such as the connecting rod and wrist pin were taken from a discarded tractor engine and used as shown in the picture to drive the splitting wedge through a welded guide. The wedge operates at 60 6-inch strokes per minute.

No tests have as yet been made to determine the kilowatt-hour consumption but it has an average demand of 600 watts and an estimated cost of three cents per hour for the electrical energy consumed by this device.

News today that means sales tomorrow

WINTER FORECAST: GOOD EATING AHEAD!

All together now . . let's can, brine, dry or freeze every extra speck of food from our Victory Gardens and farms. It will assure good eating next winter, in spite of any food shortages. Save the surplus . . . make Food Fight for Freedom.

Then pause and dream of the tomorrow when you can eat what you want regardless of harvest dates or seasons. When you'll take fruits and vegetables at the height of their sun-ripened goodness, pop them into your Westinghouse Home Freezer . . . and serve them when you will. When rare game and out-of-season foods can be the high spot of your dinner any time of year. When you'll serve today's leftover roast in a heart-warming dish, a month, even 2 months, from now. Dream of the day when exotic foods from all corners of the world . . famous cooked dishes from restaurants in Quebec or New Orleans, Rio or Bombay . . . can be stored in your freezer ready for your whim to eat them.

Thrill over the time when you can bake the pie and berry pie, cook the potatoes au gratin and chicken á la king, now . . . and serve them days, perhaps weeks later.

Pipe dreams? Not on your life! We at Westinghouse know *now* that they'll all come true. For when the war is over, we will again build a proud line of electric home appliances. And a new shining star for both city and farm will be the Home Freezer.

Meantime . . . let's all get busy and save the surplus! To help you we have a complete 48-page "Home Canning Guide". Get your free copy, write the Westinghouse Home Economics Institute, Mansfield, Ohio.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., MANSFIELD, O.
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Coming . . a New Westinghouse Home Freezer for Postwar!

30 MILLION PRE-WAR
Westinghouse
ELECTRIC HOME APPLIANCES
ARE YOUR POSTWAR PROMISE
OF STILL FINER ONES TO COME

Tune in: John Charles Thomas • Sunday 2:30 EWT., N.B.C.
"Top of the Evening". Mon. Wed. Fri. 10:15 EWT., Blue Network

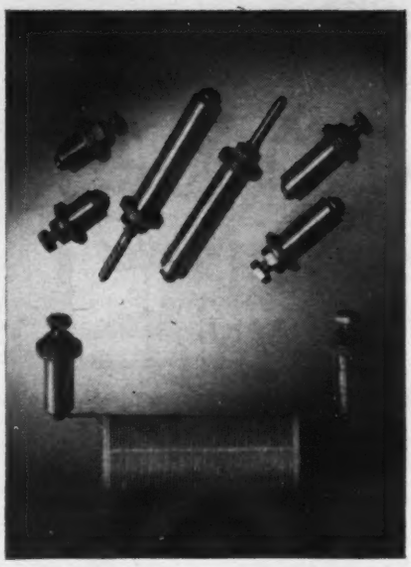
This full-page, full-color message . .

1 APPEARS IN THESE MAGAZINES . . . Saturday Evening Post, August 19 (out Aug. 16); Collier's, September 2 (out Aug. 25); Good Housekeeping, September (out Aug. 20)

2 SAYS TO YOUR CUSTOMERS "*Coming...a new Westinghouse Home Freezer for postwar*"

For further information about Westinghouse Appliance postwar plans, ask your distributor to show you the new presentation, "*On Your Mark—Get Set.*"

NEW EQUIPMENT



Infra-red heating coil: 60 turns of No. 23 nickel chromium wire; coil dimensions 3¼ x 1¼ in. in diameter; porcelain thickness 3/16-in.; length of connecting ears 3½ in.; coil raiting 3 amp. at 110 volts. **J. E. Doyle Co.**, 1224 Sixth St., Cleveland 13, Ohio.

Infra-Red Heating Coil

Heating coil is constructed by wire wound on refractory porcelain, has take off at ends to prevent wire from slipping off the core. Reinforced connecting posts are stated to reduce heat and furnish resiliency needed to cushion vibration and shock. Connecting posts are furnished in variety of lengths and styles for use with desired support or reflector. Multiple coils may be used to obtain any required heat.

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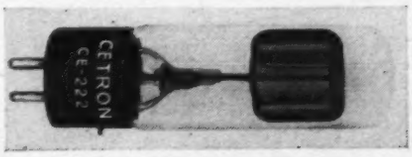

Type CE-222: gas filled: 4 pin base; 220 v. d.c.; 1 amp continuous. **Continental Electric Co.**, Geneva, Ill.

Rectifier Tube

Xenon-filled full wave rectifier tube with a reported average arc drop of 8 volts. Said to be quick heating and free from the effects of ambient temperature variations. Reported to meet requirements of RMA 3B22 and is interchangeable with it.

Resistors

Type 290 Wire-wound surge resistor; 1,000 to 3,000,000 ohms. **Shallcross Manufacturing Co.**, Jackson & Pussey Ave., Collingdale, Pa.

Surge resistor wound on non-hydroscopic ceramic forms with insulated microme wire. Protected by special finish stated to resist heat up to 450 deg. F.; reported to dissipated 200 watts. Developed for X-Ray and other high voltage applications. Reported to be used in constant potential d.c. output of a high voltage rectifying system to stabilize performance, the resistors acting as a bleeders or voltmeter multipliers.

•

Junction Box

Junction Box: 250 or 350 aluminum; sizes 17⅛ in. to 23 in. x 15 in.; cover 35½ H aluminum. **Poulsen and Nardon, Inc.**, Los Angeles, Calif.

Junction boxes made of .032 to .064 in. aluminum sheets. Boxes and covers supplied with conventional nut plate and screw type fasteners; other types can be supplied on request.

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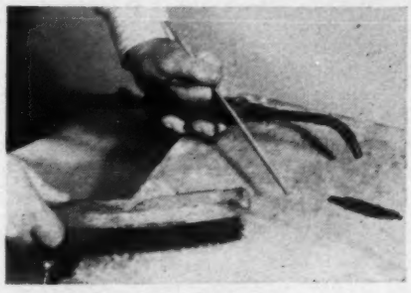


Farrelloy galvanizing solder; 14 bars per lb. **Farrelloy Co., Inc.**, 1243-45 No. 26th St., Philadelphia, Pa.

Galvanizing Solder

Solder which has an affinity for base metals usually galvanized. Applied by heating the metal, applying the solder and brushing with a wire brush or steel wool. It is said the surface will be evenly coated and leave no line of demarcation between it and original hot-dipped galvanizing. Reported to withstand salt spray bath test of 800 hours.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' products data, names and addresses.

Fastener stud: for use with sheet thickness of 0.021 to 0.5 in.; flush or round head. **Nigg Engineering Co.**, Covina, Calif.

Fastener Stud

A fastener stud controlled by a central screw which moves a sliding crosspin sleeve through a range of 0.471 in. The desired tension is reported to be obtained by one quarter turn; this also locking the fastener. It is stated that all outside measurements conform to existing standards thereby fitting all pin type receptacles. Due to wide adjustment it is usable on damaged or bent surfaces.

•

Slipstick, a wax-like graphite lubricant: 3 in. long; ⅞ in. diam. **Joseph Dixon Crucible Co.**, Jeresy City 3, N. J.

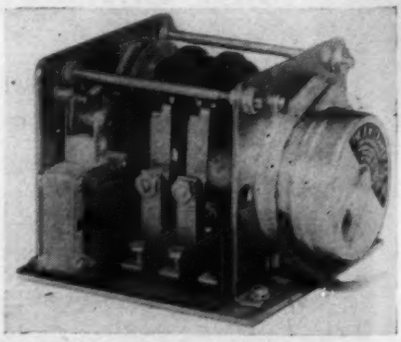
Lubricant

Formulated from unctuous flaky lubricating graphite in combination with other lubricants reported to be heat resistant and reported to adhere to wood, metal, fibre and leather.

•

Multi Contact Timer

Multi-contact timer which by remote control is said to operate machines in a definite manner; reverse or operate alternately a group of motors or in a predetermined sequence actuate a series of signals, valves or solenoids. Operated from a remote control momentary start button, the timer will go through its complete cycle or any part thereof.



Multi Contact Timer: 10 amps. at 110 v. or 5 amps. at 220 v.: **R. W. Cramer Co., Inc.**, Centerbrook, Conn.

HUBBARD AUTOGAPS *Rain or Shine!*

Hubbard Autogaps are absolutely unaffected by moisture. Exhaust ports are designed so that rain cannot enter. The all-important fibre valve element is also unaffected by moisture content in the air or actual wetness. Due to these planned characteristics there is no need for sealing Hubbard Autogaps and relying on the permanence of the seal.

Inquiry indicates that engineers have shown greatest interest in the elimination of moisture from lightning arresters and consequent faulty operation. Rain or shine, use Hubbard Autogaps!

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

● Top illustration shows the hinge end of a C-W Switch made during an ice test. The switch was warm, approximately 70°, when the spray was started and the ice deposit represents a six hour accumulation. A gradually applied pull of 60 lbs. on a 28 inch lever cracked the ice at the hubs of the cranks and freed the mechanism.

The lower picture shows the switch closed into contact through a heavy deposit of clear ice. The switch was closed at the speed of motor operation. This contact housing is not only a sleet hood but is also designed for ice breaking.

For dependable protection specify Hi-Voltage Air Break Switches.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

Inserted-primary type "Do Nut" current transformer: current ratios 200/5, 300/5, 400/5, and 500/5; accuracy one percent above 300 amps. and 2 percent for 300 and below on loads between 15 and 150 percent rated load; frequencies 25 to 133 cycles; burden 2 volt-amp. **Electric Machinery Mfg. Co.**, Minneapolis 13, Minn.

Current Transformer

"Do Nut" is slipped over the bus or conductor to be measured, taped or lashed in place if for permanent installation, and flexible leads connected to the ammeter. Transformer is said to have low-loss steel laminated core, tightly taped and impregnated with insulating, moisture-resisting varnish.

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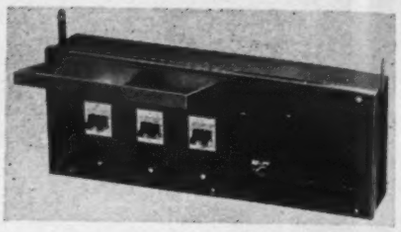

Scatter box: for 4 to 8 circuits, with or without neutral; circuits protected by 15-amp., 115-volt single-pole, type MO multibreakers; 20- or 25-amp. breakers can be substituted. **Square D Company**, 6060 Rivard St., Detroit, Mich.

Scatter Box

For controlling temporary power and light circuits through a central unit, new scatter box is designed primarily for plants where temporary circuits must be set up and torn down quickly. Hinged cover may be padlocked and openings for plug receptacles similar to Hubbel No. 7557-G are provided. Receptacles or internal wiring are not provided.

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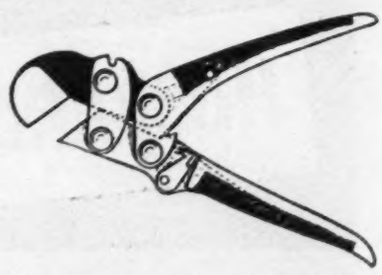

No. 250 pruning tool and wire cutter combination: 8 in. long; wt. 12 oz. **Newman Manufacturing Co., Inc.**, 1636 Central St., Kansas City, Mo.

Pruning Tool

Hand cutter with cycle-cutting motion combined with wire cutter. Is reported to cut ¾ in. wood or ¼ in. hard wire with single hand grip. It is stated that flat cutting head allows close to trunk trimming.

ANNOUNCING

The New HOLTZER-CABOT Electronic Insulation Resistance Tester

Hand Generator — eliminates batteries and external power supply. Delivers 500 Volts D.C. testing voltage regardless of the direction in which crank is turned.

Visual Indication of Correct Testing Voltage — Two indicator buttons light up when generator is delivering correct testing voltage assuring accurate readings.

Electronic Voltage Regulation — assures uniform testing voltage over a wide range of crank speeds.

Guard Circuit — eliminates surface leakage from affecting measurements.

Light Weight — a self-contained, portable unit — ready-to-use in the laboratory, plant or out in the field. Weighs only three pounds.

Wide Range — 0 to 100 megohms. Scale markings spaced for easy accurate reading.

The new Holtzer-Cabot insulation resistance tester is a precision-built unit specifically designed for insulation resistance testing of all types of electrical equipment. A self-contained testing package, it is ready to use anywhere.

Because it generates its own power through the hand crank generator, users are always assured of 500 Volts D. C. . . . there are no weak batteries to contend with. Simple and easy to use by practically any engineer or maintenance man.

Protect your equipment from insulation failures and avoid possible production delays, shut-downs, and costly repairs. Use a Holtzer-Cabot insulation resistance tester for periodic tests on *all* equipment. Write for bulletin, today.

The HOLTZER-CABOT ELECTRIC COMPANY

400 Stuart Street, Boston 17, Massachusetts

Below — Sherman 2-Hole Soldering Lug, made in standard and heavy duty types.

Below — Sherman seamless closed round end Soldering Lug.

Above — Sherman Heavy Duty 4-Hole Soldering Lug.

100% Conductivity

Since the primary function of a Soldering Lug is to carry current, here at Sherman we try to build into every lug the maximum current-carrying capacity.

For one thing, all Sherman Soldering Lugs, regardless of whether they are wrought from copper strip or stamped from tubing, are made of pure copper — rated at *100% conductivity*.

Then, too, we do a lot of other things to insure highest conductivity. We take a lot of pains to have all lugs bright and clean, for perfect soldering. We make sure there are no burrs or sharp edges. On heavy duty lugs we make the barrels extra long, to provide plenty of contact. And on *all* lugs, we insist that contact surfaces be FLAT!

If you are not already using Sherman lugs, why not give them a trial, and see for yourself the value of these additional Sherman features?

H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICHIGAN

•

Sherman
SOLDERING LUGS

TECHNICAL LITERATURE

"How Quartz Crystals are Manufactured" is an illustrated booklet available from North American Philips Company, Inc., 100 East 42nd Street, New York, containing five articles on inspection, grading and classification of quartz; orientation of crystals; sawing and orientation devices; lapping and finishing; and crystal testing.

Wear—A discussion of the Mechanism of Wear. Phenomena and Influencing Factors by D. Landan, Industrial Application Engineer of Nitralloy Corp., 230 Park Ave., New York City, contains considerable data on mechanism of wear, wear and physical properties, molecular adhesion, surface melting, specific pressures, lubricants and wear, galling, scoring, fretting, gear pitting, work hardening, chemical effects, wear in, wear out, wear of nitralloy vs. other steels plus surface finish and wear. Copy may be secured by addressing the Secretary of the Corporation.

Ducts—Bulletin No. 427-1 obtainable from the Bulldog Electric Products Co., 7610 Jos. Campan Ave., Detroit, Mich., describing and illustrating Bulldog Busdistribution Duct of the ventilated low reactance type for feeder circuits up to 2,000 amp.

Disconnecting Switches — Publication #4401, issued by Delta-Star Electric Co., 2400 Block Fulton St., Chicago 12, Ill., describing two to five thousand ampere, single pole, single throw, stick operated, straight current path, front connected indoor disconnecting switches, in voltages from 7,500 to 23,000.

Industrial Damper—Curves showing results of control of air, steam or gases from absolute stoppage to full flow by dampers, discussions on binding of dampers, dynamic balance, power requirements and maintenance are presented in a booklet, "Heacon 'Controlled Flow' Dampers," issued by Thermix Engineering Co., Greenwich, Conn.

Locomotive Standards—A manual of standards contains information on mining and industrial locomotives of the trolley, third-rail, storage battery, and combination types, also a list of other related standards. Publication No. 44-96 may be purchased from the National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y., for 75 cents.

Fundamentals of Water Cooling—A booklet designed to assist engineers and executives when planning or analyzing water-cooling facilities. Copies may be obtained from The Marley Co., Inc., 3001 Fairfax Road, Kansas City, Kans.

Toolite—New folder on "Toolite" (a thermosetting phenolic plastic) which may be obtained from Adhere, Inc., 1220 Maple St., Los Angeles, Calif. It explains the properties, characteristics, and procedures of the synthetic compound. The folder also illustrates the steps of producing tools, dies and fixtures with the material.

"Sharpshooting at Flames"—A booklet that describes and illustrates approved methods of extinguishing flammable liquid and other industrial type fires. Also describes the physical characteristics of carbon dioxide gas, the proper arrangement and distribution of extinguishers, and the organization of the plant fire-fighting system. Booklet (R-5827) may be procured from Randolph Laboratories, Inc., 8 East Kinzie St., Chicago, Ill.

PERMATOX "A"

(A Straight Toxic Wood Preservative)

For Reclaiming OLD POLES and Preserving NEW POLES

PREVENT Costly Pole Failures

With the pole shortage becoming more critical, it is vitally necessary to get the utmost service from every pole in stock or installed on your lines.

PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents) affords an effective, economical preservative treatment . . for the control of decay, shell-rot and termite attack.

Specify it for poles, posts, cross-arms, ties, crossing planks, bridge timbers and other exposed construction. Soaking or pressure treatment insure adequate absorptions and deep penetration.

•

Furnished in Two Forms:—

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX "A"
5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by The Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.

333 N. MICHIGAN AVE. CHICAGO 1, ILL.

Memphis Portland
New Orleans New York

THROW OUT

THE TERMITES!

Decay and termites cost money . . . don't permit their development. No matter what your problem, in this respect, one or more of the Dowicide family of seventeen products is ready to help you preserve wood products.

Dowicides are economical . . . thoroughly tested . . . proved by years of industrial acceptance.

The protection afforded by Dowicide is complete. Treatment may be made by impregnation or dipping. Lumber treated with Dowicide is clean, non-bleeding, paintable.

In the field of power transmission, Dowicide performs many services . . . it protects the poles . . . it saves overhead wires . . . it lengthens the life of underground cable.

For further information, write to the Dowicide Division.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
Los Angeles • Seattle

DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

WHO ARE THE *Mosinee Paperologists?*

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NEWS ABOUT PEOPLE

D. S. Young Joins Canada Wire and Cable Staff

Dudley S. Young, for the past 16 years district engineer for the western district, Anaconda Wire & Cable Co., at Chicago, has become affiliated with the Canada Wire & Cable Co. Limited at Toronto, Canada.

Subsequent to his graduation from the University of Manitoba in 1925, Mr. Young was associated in an engineering capacity with the Winnipeg Hydro-Electric System and the Detroit Edison Co. He then resumed his studies, obtaining the degree of Master of Science from the Massachusetts Institute of Technology in 1927. After serving the Electric Bond & Share Co. for a period as a rate consultant, Mr. Young joined the engineering department of the American Brass Co. in 1928, being transferred to the Anaconda Wire & Cable Co. upon its formation in 1929.

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▶ F. Bayard Culley, vice-president of the Southern Indiana Gas & Electric Co., Evansville, Ind., has been appointed by Governor Henry F. Schricker to succeed William A. Carson as a member of the state economic council. Mr. Carson, president of the Sunbeam Electric Manufacturing Co., asked that he be relieved from the position because of the state of his health. Mr. Culley is also chairman of the Evansville Post-War Planning Council.

N. J. Power & Light Makes New Staff Appointments

At the recent annual meeting of the stockholders of the New Jersey Power & Light Co., H. C. Thuerk, president, outlined the changes in the supervisory personnel which were brought about in connection with the establishment of the executive management of the company at Dover last November.

R. R. Parker, formerly assistant treasurer of NY PA NJ Utilities Co., the parent company of New Jersey Power & Light Co., has been elected a vice-president, treasurer and director. R. N. Malehorn was elected secretary.

The new position of chief engineer has been filled by J. P. Mailler, formerly chief engineer of the Northeastern Water & Electric Service Corp. Mr. Mailler will be in charge of the operating, construction, engineering and transportation departments.

P. P. Kinnaman, formerly division operating superintendent, has been promoted to electrical engineer and has appointed S. A. Mitterling as distribution engineer. William E. Liepe, formerly engineer and sales manager for the Bradford Electric Co., Bradford, Pa., has been appointed rate and research engineer.

Following the resignation of F. S. Hoefer, formerly general sales manager of the company, W. G. Parry was placed in charge of all power sales and industrial development activities. W. F. Moses, formerly division manager of the New York State Electric & Gas Corp. at Cortland, N. Y., has become domestic sales and advertising manager.

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▶ Dr. John B. Wilbur has been appointed acting head of the department of civil and sanitary engineering at the Massachusetts Institute of Technology, succeeding the late Prof. T. B. Parker. Dr. Wilbur, who has had wide experience in railroad, bridge and consulting engineering activities, is well known in the electrical field through his connection with the Smith-Putnam wind turbine project on Grandpa's Knob, near Rutland, Vt., and as chief engineer for the S. Morgan Smith Co. He has been teaching continuously at M.I.T. since 1930, having been made professor of structural engineering in 1943.

•

Schanuel Made Executive Secretary of I.C.I.

Arthur E. Schanuel has been appointed executive secretary of the Indoor Climate Institute, Detroit, Mich., effective as of July 1. Mr. Schanuel resigned the position of secretary of the National Electrical Manufacturers

Association to assume his new duties. He is a former newspaper and advertising man and has a wide acquaintanceship in the public utility and building fields.

"With the appointment of Mr. Schanuel, the I.C.I. rounds out its first year with a complete program of organization and the establishment of policies which should give great scope, of far-reaching value to the Institute's operations," stated P. B. Zimmerman, president of the Institute in announcing Mr. Schanuel's appointment.

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▶ Lt. Commander J. A. Krug, USNR, has been sent to the European theater of operations on a special mission for the Secretary of the Navy. His assignment will take him to Italy and England.

▶ J. L. Calpin, industrial power engineer Public Service Co. of New Hampshire, Manchester, N. H., has been

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elected chairman of the Power Engineers Association of New England. C. R. Broadhead, head of the power sales department, Narragansett Electric Co., Providence, R. I., has been named vice-chairman, and J. V. Dempsey, power sales engineer Central Vermont Public Service Corp., Claremont, N. H., has been elected secretary-treasurer.

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Connecticut Light Makes District Appointments

Alfred M. Wade, manager of the Rockville-Stafford district of the Connecticut Light & Power Co. since December, 1941, has succeeded the late Frederick J. Lyon as manager of the Greenwich district. Mr. Wade is a graduate of Union College, Schenectady, N. Y., and joined the company in 1924 in the advertising department. In 1928 he resigned to enter the service of the General Motors organization, and later spent three years as assistant sales manager in India. He returned to the Connecticut utility in 1932, joining the sales department, and nine years later went to Rockville. Donald R. Weekes, Greenwich office manager, has become manager at Rockville, and has been succeeded at Greenwich by J. George Westerman, former traveling auditor of the company. Mr. Weekes joined the company in 1928 and was appointed to his late post in Greenwich in 1934. Mr. Westerman entered the company's service in 1929 and has been on the traveling auditing staff since 1936.

Henry C. Chapin, former district engineer at Greenwich, has been appointed electric foreman for the southern division, having charge of all substation operation and maintenance in Greenwich, Norwalk and five other municipalities. Daniel Forger, who entered the company in 1922 as a meterman, and who has since worked on electric distribution layouts, maintenance and construction as assistant engineer, becomes district engineer at Greenwich.

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▶ J. CECIL PARK, who has been connected with the Arkansas Power & Light Co. for 30 years, has been appointed manager of that utility at Russellville to succeed B. C. Fowles, retired. Mr. Fowles has been manager at Russellville for 23 years.

▶ DANIEL RIEDEL, general superintendent of the Central Ohio Light & Power Co. at Findlay, Ohio, for more than 30 years, has retired. E. W. MULLIKIN, formerly operating superintendent of

How Much Longer Will Your Boilers Stand Up?

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In these days of supercolossal war schedules, do you ever worry about the condition of your plant boilers? Do you wonder what you can do to prolong their life until the time when scarce metal becomes plentiful once more?

Many maintenance engineers have found the answers to these questions in APEXIOR . . . a special protective coating purposely made for boiler and turbine metal.

They have used APEXIOR on new equipment as well as on old equipment . . . on new equipment to insure against premature old age, on old equipment to prolong its useful service. They have, in some cases, been able to salvage discarded boilers that seemed to have outlived their usefulness by cleaning them and then coating them with APEXIOR.

APEXIOR PREVENTS CORROSION FOR 2-3 YEARS

APEXIOR is brush-applied, by hand or power coater. It seeps into the metal pores and joints and forms an impenetrable barrier against water. There is less adherent scale, so scale removal is required less often . . . and when it is necessary, the job can be done easily with a wire brush.

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Back the Attack ...Buy More War Bonds

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the Virginia East Coast Utilities, Inc., West Point, Va., has been named to succeed him.

► E. F. SCATTERGOOD, consulting engineer to the Los Angeles Bureau of Power & Light, was the recipient of an honorary degree conferred at the commencement exercises at University of California at Los Angeles. The degree was awarded in recognition of Mr. Scattergood's achievement in the field of engineering.

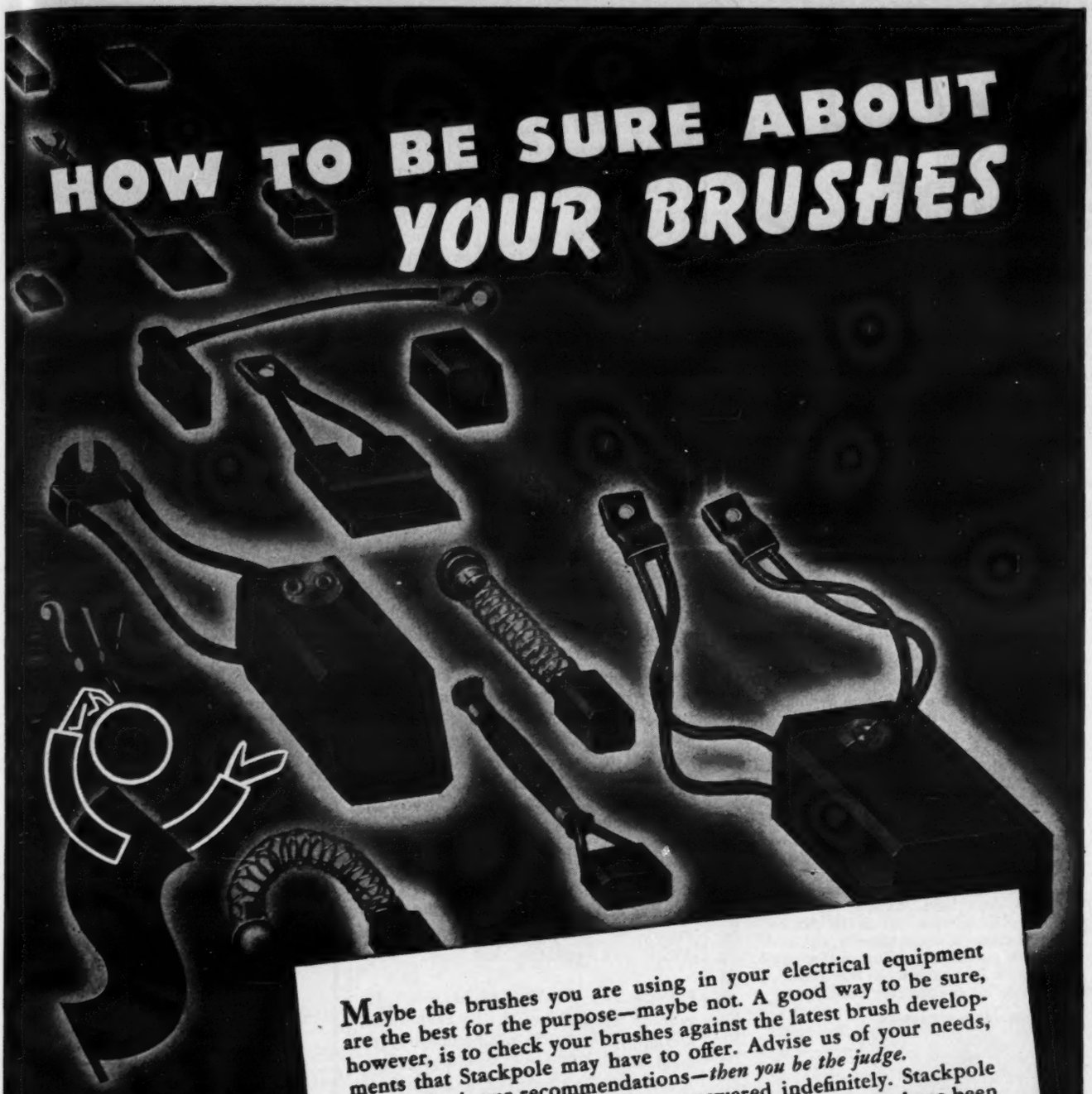
A. F. DICKERSON (right) General Electric lighting division manager, is congratulated by Dr. F. M. Law, Texas A. & M. College board chairman, upon receiving the honorary degree of doctor of engineering. Mr. Dickerson was so honored for "distinguished service in the field of illumination . . ."

► F. C. MARGOLF has been appointed manager, home laundry equipment sales division, Edison General Electric Appliance Co. Mr. Margolf joined the Hotpoint organization in 1937. Recently he has been assigned to commercial cooking equipment work with the U. S. Government in Washington. For the present, Mr. Margolf will retain his Washington office and continue his Government activities. Later he will be located at Hotpoint headquarters, Chicago.

► JOHN G. FARRAR was elected comptroller of the General Electric Co. at the lamp department headquarters of the company in Cleveland. Since March of this year, when Ira D. LeFevre, comptroller, was granted a leave because of ill health, Mr. Farrar has been acting comptroller. Mr. LeFevre died two weks ago.

► CARROLL M. SNYDER, formerly vice-president in charge of naval ordnance production at the Herring, Hall, Marvin Safe Co., Hamilton, Ohio, has joined the C-O Two Fire Equipment Co., Newark, N. J., as assistant to the president. A graduate of Stevens Institute

HOW TO BE SURE ABOUT YOUR BRUSHES



Maybe the brushes you are using in your electrical equipment are the best for the purpose—maybe not. A good way to be sure, however, is to check your brushes against the latest brush developments that Stackpole may have to offer. Advise us of your needs, let us submit our recommendations—*then you be the judge.*

For brush problems don't stay answered indefinitely. Stackpole brush engineering moves too fast for this. Units that may have been "best" yesterday, may be outmoded in the light of today's developments. It costs you nothing to check on this score—and the Stackpole recommendations may spell new efficiency for your product.

Stackpole Brushes are sold only to makers of original equipment—not direct for replacement purposes.

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PIONEERS OF BRUSH PROGRESS

"Mr. Tops," The Paragon Symbol of Top Quality.

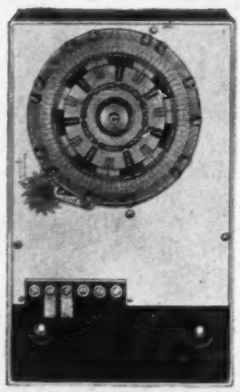
LET "MR. TOPS" CONTROL YOUR TIMING of

***Automatic* HEATING, VENTILATING, LIGHTING, PUMPING OR FLUSHING OPERATIONS . . .**

Paragon 700 Series Time Switches are equipped with 6" calendar dials which make one complete revolution every 7 days. Dial trippers can be independently set for different daily ON and OFF schedules. Settings can be made in advance for an entire week. Any day or days operations may be omitted entirely on a pre-set program.

Each day of week clearly separated from other days; graduated into hours and half hours; day and night distinctly separated. Operations from ON to OFF or from OFF to ON can be set as close as three hours apart and can be separately adjusted throughout each 24 hour day in the week.

Write for a complete bulletin.



Paragon 700 Series Time Switch

PARAGON ELECTRIC COMPANY
703 Old Colony Building
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Paragon *Chicago*
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

of Technology, Mr. Snyder was associated with Stone & Webster, Inc., from 1924 to 1942.

▶ WARD R. SCHAFER has been appointed regional sales manager of the western region for Edison General Electric Appliance Co., Inc., with headquarters in San Francisco. Mr. Schafer joined Hotpoint in 1924.

▶ J. M. DOLLENMAIER has been appointed to the position of assistant to the vice-president of the Line Material Co. at the Milwaukee, Wis., main office of the organization. Mr. Dollenmaier has been connected with Line Material since 1934 when he joined the company as field engineer. In 1937 he took charge of the Line Material office in Detroit as manager of the Detroit metropolitan and Michigan territory from which position he has just been promoted. Mr. Dollenmaier spent a short period with the Public Service Co. of Northern Illinois and before joining Line Material had been connected with the Illinois Commerce Commission.

▶ G. KEITH FUNSTON has been made president of Trinity College at Hartford, Conn., and a lieutenant commander in the United States Navy almost simultaneously. He recently returned to Sylvania Electric Products Inc., as director of purchases, after a two-and-a-half-year absence from the company, during which he served with WPB.

▶ Dr. LAWRENCE KING has been appointed managing director of the Corning Glass Works of South America which was organized last year.

▶ FREDERICK A. O'LEARY has been appointed acting chief of the radio-radar section of the WPB, production department, Boston, Mass., succeeding Michael Scott, who has received a commission in the U. S. Navy. Mr. O'Leary was formerly with the Raytheon Mfg. Co., Waltham, Mass., and the Eastern Co., Cambridge, Mass.

▶ EARL R. SAYRE has been appointed application engineer for P. R. Mallory & Co., Inc., Indianapolis, Ind., for the company's line of electrical, electronic, and metallurgical products. Mr. Sayre was formerly associated with the Arrow-Hart and Hegeman Electric Co.

▶ A. C. SCOTT has been appointed vice-president in charge of sales for the Apex Electrical Manufacturing Co., Cleveland, Ohio. Mr. Scott will direct all sales activities of the company plants at Cleveland and Sandusky, Ohio, now devoted entirely to the production of war work, but normally manufacturing

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

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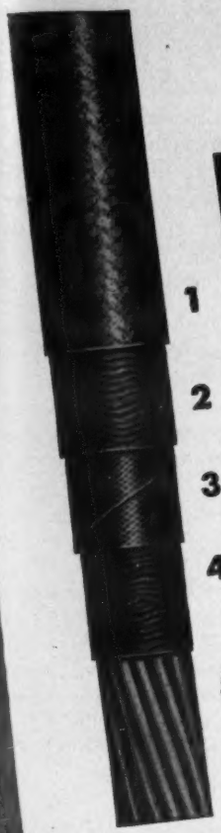
1 POINTS THE WAY TO LONG WIRE LIFE
2 exposed to severe operating conditions
3 in lighting control and power circuits



4 Rockbestos A.V.C. Power Cable above, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

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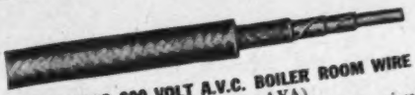
1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Outer felted asbestos wall, also impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.
3. Lubricated varnish cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two impregnated asbestos walls.
4. Felted asbestos insulation, impregnated with heat-, flame-, and moisture-resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.
5. The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

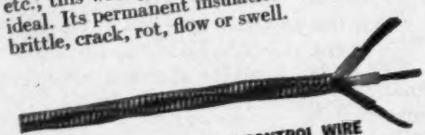
WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.



ROCKBESTOS 600 VOLT A.V.C. BOILER ROOM WIRE
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 AWG. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.



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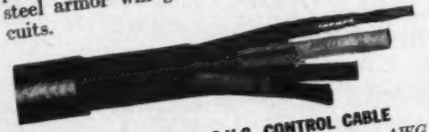
Sizes No. 14, 16 and 18 AWG in two to six conductors with .0125", or .025" or (for 115 volt service) .031" of felted asbestos insulation and steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal, and temperature control systems. Its lifetime heat-proof and fireproof insulation and rugged steel armor will give you troubleproof circuits.



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In one to 19 conductors. Standard stranding AWG No. 12—19/25 and No. 9—19/22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

Looking for a wire with a tough enough insulation to give years of trouble-free service in hot locations? Around forging presses, soaking pits, steam tunnels, lehrs, kilns, hot strip mills? In locations where heat, moisture, grease, fumes, etc. are playing hob with your present wires? Then investigate Rockbestos A.V.C.

Designed specifically for operation under severe conditions and in "hot-spot" locations, these Rockbestos A.V.C. wires, cables and cords have a permanent asbestos insulation that stands up where other wires fail. The naturally heatproof asbestos insulation, impregnated with heat-, flame-, and moisture-resisting compounds, withstands conductor heating overloads. It won't bake brittle, dry out, flow, rot or crack under heat and resists oil, grease and corrosive fumes.

Get trouble-free long wire life in your circuits by installing Rockbestos A.V.C. 122 constructions give you a wide range of choice to meet specific requirements. When ordering or inquiring, please furnish CMP allotment number or symbol, and certification. For complete information and samples, write nearest branch office or:

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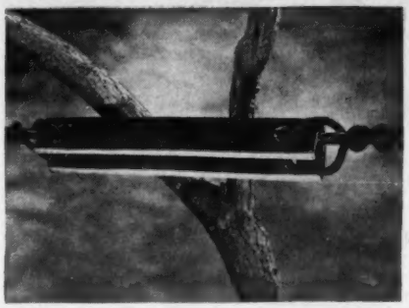

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PINCO tree insulators provide the answer

Costing less than a single tree trimming, a Pinco Tree Insulator pays for itself in a short time, not only in dollars and cents savings but also in the grief it saves the public relations department.

ALL PORCELAIN . . . Made entirely of Pinco High Test Porcelain it offers the insulating protection only porcelain can give and is unaffected by moisture or the abrasive action of rubbing branches.

EASILY INSTALLED . . . The Pinco Tree Insulator is easy to install. It needs only to be placed *on* the wire at the point of contact and secured at each end with tie-wires. Available in 12, 14 and 16 inch lengths. Where needed several units may be tied together. Write for complete information and prices.

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PORCELAIN INSULATOR CORPORATION, LIMA, N. Y.
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TITLE.....

COMPANY.....

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electric vacuum cleaners, washing machines and ironing machines for household use. Mr. Scott became identified with the Apex organization in 1932.

•

New Officers Elected by Benjamin Electric

J. H. Fall, Jr., chairman of the board of the Benjamin Electric Mfg. Co., Des Plaines, Ill., and its chief executive officer since 1928, has retired from active participation in the management of the company after 32 years of service. He will continue to act in an advisory capacity on financial matters. Walter D. Steele, who has been president since 1928 and has been associated with the company since it was founded in 1901, will direct all operations of the company.

Other officers elected are: Hoyt P. Steele, vice-president; J. H. Fall III, vice-president and general sales manager; C. F. W. Alfvin, treasurer; R. Allen Benjamin, secretary; George A. Hamm, controller; C. B. Harlow and Miles F. Steel, divisional vice-presidents; F. G. Klingel, assistant treasurer; and Mary Asping, assistant secretary.

•

▶ DR. LAWRENCE W. BASS, director of the New England Industrial Research Foundation, has resigned to become associate director of reasearch of the Air Reduction Co., Inc., and the United States Industrial Chemicals Co., Inc., with headquarters in New York City. Dr. Bass joined the Foundation in 1942, soon after that organization had been established under the auspices of the New Products Committee of the New England Council, of which President Karl T. Compton of the Massachusetts Institute of Technology was chairman. Dr. Bass will continue with the Foundation in the capacity of technical consultant.

▶ GARET W. DENISE has been appointed general manager of Chicago plant operations of Littelfuse, Inc. Mr. Denise was formerly connected with the Republic Aviation Corp., Farmingdale, L. I. DEE BREEN was recently appointed western division sales manager of the company with territory covering the western states and headquarters at the company's plant, El Monte, Calif. Before the war Mr. Breen was connected with the Chrysler Corp.

▶ ROY W. JOHNSON has been appointed general sales manager in charge of all commercial activities of the Warren Telechron Co. of Ashland, Mass. Mr. Johnson was formerly director of the facilities bureau of the War Production Board and previously had been associated with the General Electric Co. and Schick, Inc., in sales and advertising capacities. There will be no changes in the Warren Telechron sales organization. David Blair, Jr., continues as sales manager and Harold E. Blackburn as assistant sales manager.

▶ DR. PAUL E. WILLIAMS, director of Jefferson College, St. Louis, for the past 10 years, has joined Owens-Corning Fiberglas Corp. as director of the company's newly-expanded education program. The program is an extension of a training program that has been in effect in the Fiberglas factories for several years.

▶ LEROY M. EDWARDS, vice-president of Pacific Lighting Corp. and general chairman of the Los Angeles (Calif.) Citizens Manpower Committee, recently was named a member of the Southern California Management-Labor Committee of the WMC, succeeding Kenneth T. Norris, who resigned.

▶ GARLAN MORSE has been appointed production manager, incandescent and fluorescent lamps, Sylvania Electric Products, Inc., Salem, Mass. Mr. Morse has been Philadelphia sales manager for the lighting division. He joined Sylvania in 1936, working on construction and cost accounting in the radio division. Transferring to the lighting division, he was on the New England Sales staff, then on wiring devices, before the assignment at Philadelphia.

▶ G. A. HARRIS, formerly manager of the appliance division of Canadian General Electric Co. Ltd., has been named sales manager of the company's supply department.

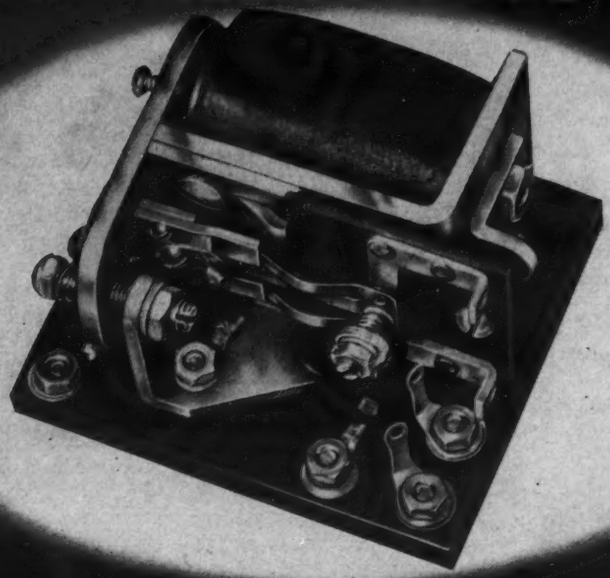
▶ E. H. BRODEN, manager of operations of the Pittsburgh district of the American Steel & Wire Co., has retired after almost half a century of service with the company. Succeeding Mr. Broden will be L. F. MCGLINCY, formerly assistant manager of operations of the Pittsburgh district.

OBITUARY

▶ H. EDWARD MANVILLE, retired board chairman and former president of the Johns-Manville Corp., of which his father was a founder, died of pneumonia at Pleasantville, N. Y., on June 27. He was 72 years of age. Mr. Manville had been an official of the Johns-Manville Corp. for 38 years. After retiring in 1939, he served in an advisory capacity.

STRUTHERS-DUNN

RELAY TYPE 79XAX



Sensitive, Snap-Action Operation

FOR USE ON SLOWLY-VARYING COIL CURRENTS

EXTREMELY CLOSE DIFFERENTIAL

...between pick-up and drop-out for either current or potential operation may be obtained by use of a resistor across the coil of the 79XAX, thus reducing coil current to a value just sufficient to hold the contacts closed. Any further decrease in current or voltage will operate the contacts.

Extreme sensitivity can also be obtained by use of a resistor, and the addition of a special coil to the 79XAX. These maintain the relay in a balanced condition. Any slight unbalance of the bridge or other power source will, through the upper coil, buck or boost the lower coil and cause the contacts to snap-operate.

In addition to all of the advantages of conventional sensitive relays, Struthers-Dunn Type 79XAX is designed so that its armature practically completes its travel *before* the contacts snap-operate to the corresponding position. This, plus the fact that contacts remain closed *with full pressure* up to the instant of transfer, permit this relay to be used in a number of unusual ways. Such applications include overcurrent protection particularly in the range of 1 to 100 milliamperes, or in connection with shunts furnishing potentials in the range of 1 to 100 millivolts; pulsing circuits where the relay must "pump" or "scratch its own back"; sensitive vacuum tube circuits, and various others.

Normal sensitivity is 0.01 watt, although this sensitivity can be heightened by means of various circuit arrangements. Contact arrangement is S.P.D.T., and contact rating 10 amps. 110-V a.c., and 10 amps. 24-V d.c. Balanced construction withstands 10 G vibration and shock. Write for Data Bulletin describing this relay and giving circuit diagrams.

STRUTHERS-DUNN, INC., 1321 ARCH STREET, PHILADELPHIA 7, PA.

ONE OF THE STRUTHERS-DUNN

5,288 RELAY TYPES

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HARTFORD INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL • NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

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May we have your help? Please don't wait until the last minute to renew your subscription to Electrical World because you might forget and then the best we could do would be to put your name on the waiting list of around a thousand and it might take three months or more before your name would come up.

And that isn't all. Even when your name does come up we shall not be able to supply the missed copies to fill out your file. We have no more extra copies.

This is an unusual situation for a publisher to face but the fact is that paper is extremely short due both to an increased demand for packaging of war materials for shipment overseas and to a shortage of labor in the woods. Supply of wood products of which paper is one of the most important is in the same critical position that copper products were in a year ago.

Like all other publications, we are operating under a fixed allotment of paper, having had two cuts. We did not cut the editorial content nor reduce the number of subscribers. What we did was to freeze our circulation at the current figure and then, as waiting lines of new subscribers began to grow, we adopted the policy of cutting off subscriptions promptly on expiration—not, however, without giving each subscriber at least four notices of expiration in time for him to send in his renewal.

We would much rather serve an old subscriber than a new one if it were a matter of choice. We don't, however, feel that a new subscriber should be denied copies while we are waiting for someone to make up his mind.

We will do everything within our power to serve you without a break if you will help us. Please answer renewal notices promptly.

Electrical World

330 W. 42nd STREET, NEW YORK, N. Y.

April Energy Sales Advanced 10%

Sales of electric energy to ultimate customers in April totaled 16,296,452,000 kw.-hr., compared with 14,769,380,000 kw.-hr. in April, 1943, an increase of 10.3 percent, according to the report issued by the Edison Electric Institute.

Revenue from ultimate customers amounted to $270,205,400, compared with $249,223,500 in April, 1943, an increase of 8.4 percent.

Classification of Sales, April, 1944 and Change from 1943

Kilowatt-hour sales April	Million kw.-hr. 1944	1943	% Change
Residential or domestic	2,592	2,319	+11.8
Rural (Distinct rural rates)	255	195	+30.7
Commercial or industrial			
Small light & power	2,413	2,269	+ 6.3
Large light & power	9,319	8,472	+10.0
Street & Highway	167	161	+ 3.8
Other public authorities	863	671	+28.6
Railways & Railroads			
Street & Interurban	381	384	— 0.8
Electrified Steam	222	213	+ 4.1
Interdepartmental	84	85	— 0.9
Total to ult. customers	16,296	14,769	+10.3

For the twelve months ended April 30, the average annual use per customer advanced to 1,104 kw.-hr. from 1,032 kw.-hr. for the preceding year, an increase of 7.0 percent; the average annual bill to $39.30 from $37.67, an increase of 4.3 percent; revenue per kilowatt-hour dropped to 3.56 cents per kilowatt-hour from 3.65 cents, a decrease of 2.5 percent under the preceding twelve months.

•

More Items Subject to Export License

The Foreign Economic Administration in its Current Export Bulletin No. 164 has added 175 items in twelve different commodity groups to the list of commodities which may be exported to other American Republics under the BLT (Blanket) export license procedure. Under this procedure, designated commodities may be shipped to more than one consignee in any Latin American country that does not require import recommendations for the commodity shipped.

Certain electrical products were listed as follows: batteries, bells, buzzers, annunciators, metallic electric conduit, outlet and switchboxes, cut-outs and switches under 2,300 volts, various fluorescent and incandescent lamps including infra red heating and drying equipment, various lighting fixtures and parts (interior and exterior), microphones, sockets, outlet, fuse blocks, lighting switches, etc., speakers, specialty transformers, electronic cibractors, wiring supplies and line materials, welding rods, portable power driven tools.

•

Shipments Increase Beaver Reports

Shipments of the Worthington Pump & Machinery Corp. in the first quarter this year increased to $42,008,039 from $37,301,397 a year ago, Harry C. Beaver, the president, reported at the recent annual meeting of stockholders. He said the backlog of unfilled orders continued at a high level, sufficient to assure near-capacity operations for the year, although in recent months incoming new orders had showed a downward trend.

Net income for the March quarter amounted to $1,027,316, or $3.08 each on 280,082 common shares, against $870,141, or $2.61 each on 267,863 shares outstanding a year before.

Studies relating to reconversion are being made and new post-war products will fit closely into the company's production facilities and sales distribution, Mr. Beaver declared.

•

New Brunswick Negotiates For Electric Utilities

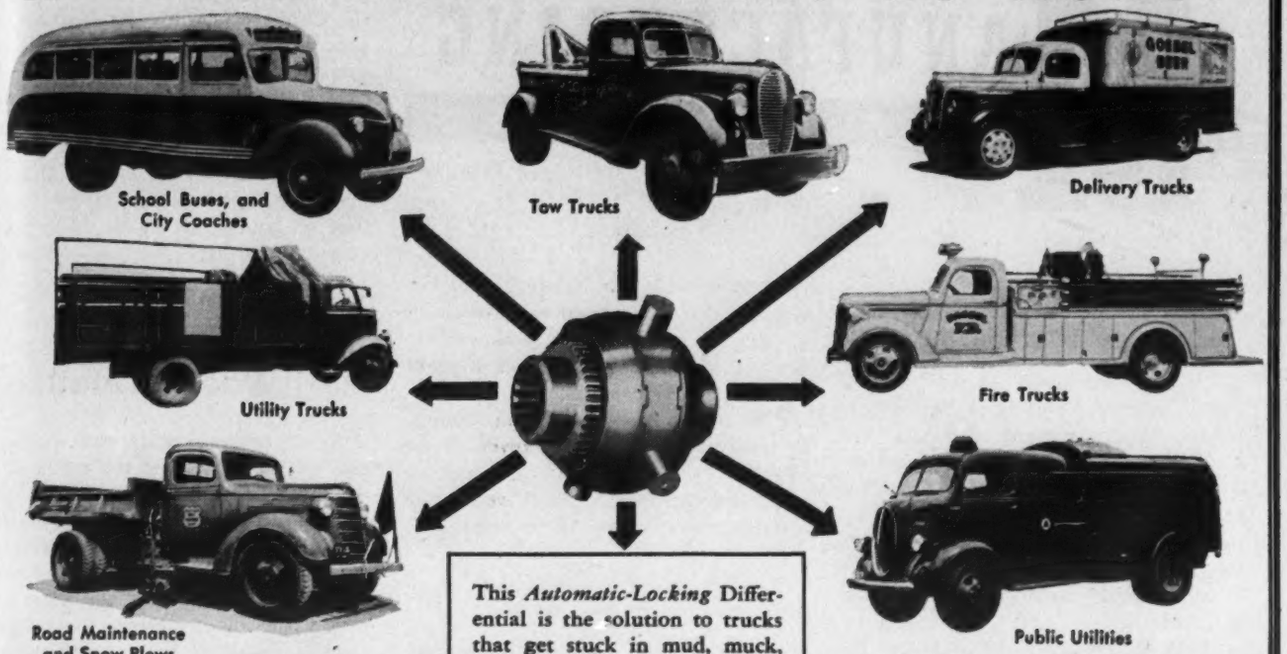
The New Brunswick government has been negotiating with the New Brunswick Power Co., St. John; Moncton Electricity & Gas Co., Moncton; Aroostook Power Co., Presque Isle, Maine; Maritime Electric Co., Fredericton and St. Stephen, for the acquisition of the electric power plants and transmission lines of these companies. The objective in this proceeding is to turn all four power companies over to the New Brunswick Electric Power Commission for future operation.

•

San Diego Wage Raise

Following approval of the wage adjustment board in Washington, electrical workers in San Diego, Calif., have been awarded a wage increase from $1.50 to $1.70 an hour by the War Labor Board. The new wage scale, affecting 500 workers, was made retroactive to May 4, it was announced by the electrical workers business agent recently. The new pay rate puts workers on non-federal building construction or repairs on the same scale as federal electrical workers, whose wages were boosted March 10.

A STUCK TRUCK EARNS NO MONEY



This *Automatic-Locking* Differential is the solution to trucks that get stuck in mud, muck, sand, gravel, snow or on sleet, etc.

Install at Once

THORNTON *Automatic-Locking* DIFFERENTIAL

Your vehicles must keep moving to perform their functions and for you to realize any adequate return on your investment. We believe the surest safeguard against a truck sticking is the THORNTON *Automatic-Locking* DIFFERENTIAL. Spinning of one wheel, which normally stalls a vehicle in deep dirt, or mud, muck, sand, snow or on ice, seldom occurs when this differential is installed, because both wheels *must* rotate when power is applied.

You will be surprised at the manner a Thornton-equipped truck outperforms others that slip, skid, slew or stall—the way it backs up or turns.

Insuring traction saves you precious rubber, gas, oil, chains, manpower, tow costs and time.

A. Spider and Center Cam Ass'y

B. Driven Clutch and Cam Members

C. Spring Retainers

D. Springs

E. Side Members

F. Retainer

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Model 1061 for Ford 1½ ton trucks with single speed axles.
Model 2061 for Chevrolet 1½ ton trucks with single speed axles.
Model 5061 for International Trucks (Model K-3) with single speed axles.
Model 5062 for International Trucks (Models K-4 and K-5) with single speed axles.
Model 5061 for International Trucks (Models K-6 and K-7 or earlier equivalents) with single speed axles.

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MANUFACTURING MARKETS

Urges Early Easing of Price Controls

Rigid government price control should be repealed early in the post-war period "because many products will need higher prices, at least temporarily," Frank D. Newbury, vice-president of Westinghouse Electric & Manufacturing Co., stated in an address before the meeting of the American Society of Mechanical Engineers held recently in Pittsburgh.

"Both the volume of business and the general price level will be higher following the war than they were before 1940," he said. "No wild up-surge in prices is expected," he continued, "but we can reasonably expect a general post-war price level one-third to one-half above that of 1940. Industry will need freedom from rigid price control if companies are to weather the storms of this post-war period."

Westinghouse, Mr. Newbury said, had guessed that its post-war sales would be 60 percent of the 1944 peak-war deliveries, but also "175 percent of maximum pre-war production."

"We see no new factor strong enough to level off the ups and downs of the business cycle," he said, "although we hope and expect the recent violence of the depression years can be mitigated."

•

Power Plant Improvement Announced by Formica

A $150,000 investment involved in expanding and modernizing the power plant at the Formica Insulation Co., Cincinnati, will be completed when power plant installations are ready for the peak winter loads, the company has announced.

The installations include a new boiler with a new ash disposal system, new stoker and other facilities designed to help meet the production demand upon the Formica facilities for wartime output. Plans have been completed for a new coal handling system, but this improvement will not be undertaken until after the war.

Announcement has also been made of the completion of a special building to house the tube ovens used for production of laminated plastic tubes under conditions of high pressure and heat.

•

Rubber Replaces Wood in Batteries

A microporous, wafer-thin rubber is now replacing wood in the manufacture of storage batteries. Its use as a plate separator makes possible for the first time the shipment of these batteries to all battlefronts in a fully charged condition but without the acid and water heretofore necessary to insure the electrical charge as well as the life of the battery.

This material, developed by the United States Rubber Co., has millions of tiny cells per square inch and unlike wood will not buckle should the protecting acid and water mixture become low or completely expended.

Buckling of wood separators was considered by the battery industry as the prime reason for battery failures. The use of rubber eliminates this possibility as these separators have five times the life of wood in a 1.25 specific gravity acid.

It has higher resistance to abrasion and chemical reaction than has wood. The separators are designed to outlast the life of the battery.

The use of this material as a battery separator permits complete charging of the unit at the point of manufacture, plus shipment minus the liquid.

After the battery has been completely charged, the acid is taken out, the plates and separators are moved and dried, and after all moisture has been eliminated, the battery is again sealed. They retain 75% of the original charge after being placed in storage for more than a one-year period. This method of charging, drying, and shipping makes possible the immediate use of the battery after distilled water and acid have been added.

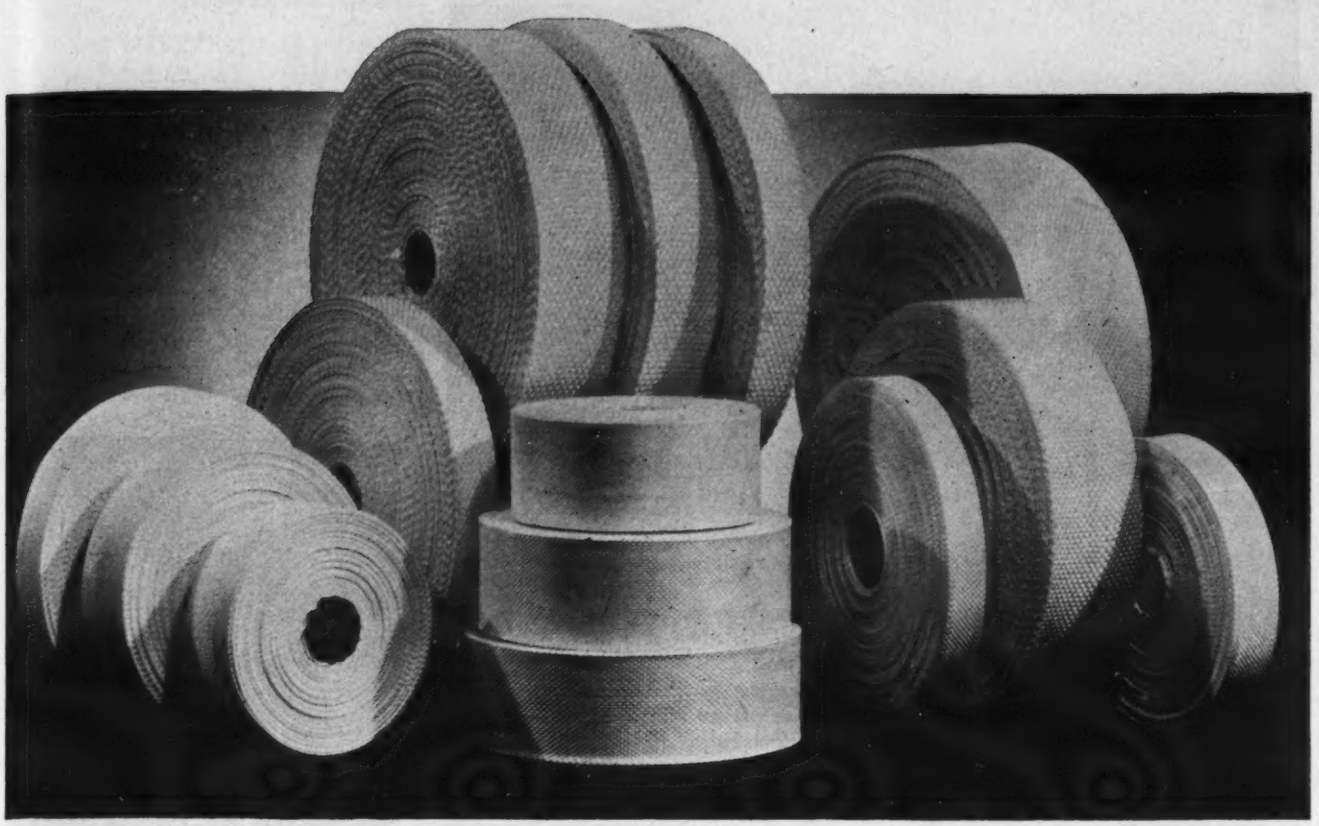
•

Shipments Up 25 Percent

Shipments of the storage battery division of Philco Corp. in the first four months of 1944 were 25 percent greater than in the corresponding period last

TOUR OF INSPECTION—Seeking first hand information concerning West Coast manufacturing operations of his company, K. R. Van Tassel, sales manager, integral-horsepower motor section, of General Electric's motor division, Schenectady, inspects a Tri-Clad motor at the G.E. plant in Oakland, Calif. It was the first visit of Mr. Van Tassel to the Pacific Coast since his appointment to the Schenectady headquarters in 1942. (Right) John Hood, manager of the Oakland G.E. works

AVAILABLE NOW...



FIBERGLAS* TAPES TO MEET EVERY WINDING NEED

An extraordinary combination of inherent qualities makes impregnated Fiberglas Tape a better insulating material. Fiberglas-insulated motors—operating under conditions of high ambient temperatures, high humidity, overloads, or in the presence of acids, oils and corrosive vapors — last longer, require rewinding less often, are more economical.

Fiberglas Tapes are produced in all standard widths—from 3/8" to 1½"—and in thicknesses from .003" to .015". All of these sizes are available now!

This range of widths and thicknesses permits the rewinding of motors with Fiberglas regardless of previous insulation used.

Because Fiberglas is glass, Fiberglas Tapes provide an inorganic insulation of exceptional value in electrical applications.

The individual glass fibers are nonhygroscopic—a property of major importance in many electrical applications.

Some of the other superior benefits Fiberglas Tapes offer are: great tensile strength; high temperature resistance; high dielectric strength and insulation resistance when combined with appropriate varnishes or impregnants.

For full information or samples of the complete line of Fiberglas Electrical Insulation, consult your distributor or write *Owens-Corning Fiberglas Corporation, 1858 Nicholas Bldg., Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

ARMY E NAVY

FIBERGLAS* ***...A BASIC MATERIAL***

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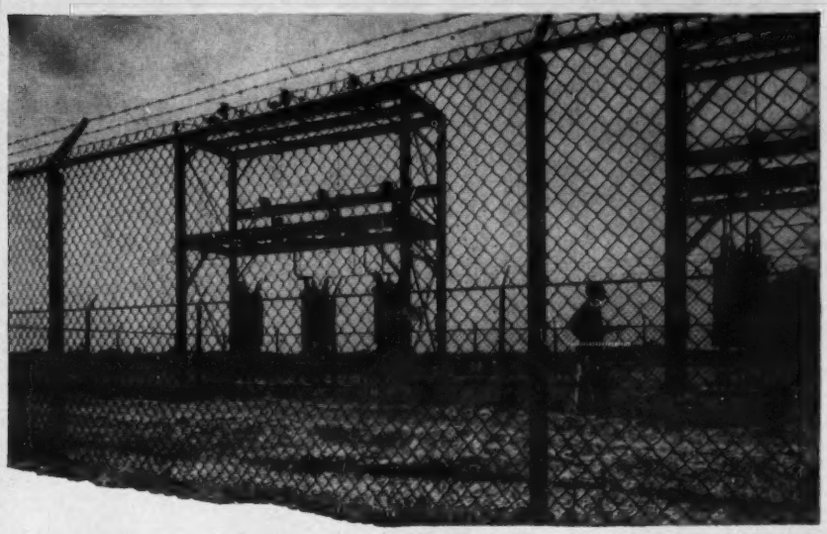
PAGE FENCE - Since 1883

• AMERICA'S FIRST WIRE FENCE •



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No expensive replacements . . . and the initial cost is lower than stencil methods. Get full details.

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Premax Products

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4418 Highland Ave., Niagara Falls, N. Y.

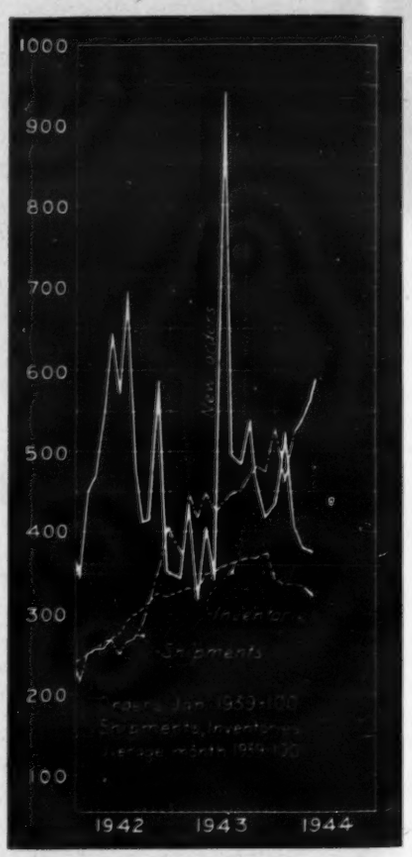
year, M. W. Heinritz, vice-president in charge of the division, has announced. The division's entire production is going directly, or indirectly, to the war effort.

•

Machinery Shipments Hit New High Mark

Shipments of the electrical machinery industry in April increased to a new high, the index compiled by the Bureau of Foreign and Domestic Commerce advancing sharply to 577, compared with 543 (revised) in March. This compares with 450 in April, 1943.

Following the general trend in April, when the value of all business inven-



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

tories declined, the index covering electrical machinery dropped to 330.3 from 338.1 (revised) in March, the Bureau reports. In April, 1943, it was 350.4.

While the value of new orders received by manufacturers in April was at the highest rate in the past six months and the most striking increase was recorded by the machinery industry, the electrical machinery group did not share in this upswing. The index for this group, compiled by the Bureau, stood at 388 in April; 389 (revised) in March; 406 in April, 1943.

CLARE TYPE "C" RELAY

For Utility Application Where Rapid Opening and Closing of Circuits is Required.

★

FEATURES

1. Contacts are made from precious metals and alloys, such as silver, palladium, palladium-iridium, tungsten and elkonium. They can be furnished in sizes from .062" silver, rated at 1 ampere, 50 watts, to .1875" tungsten, rated at 4 amperes, 500 watts. Various types can be incorporated in one relay.

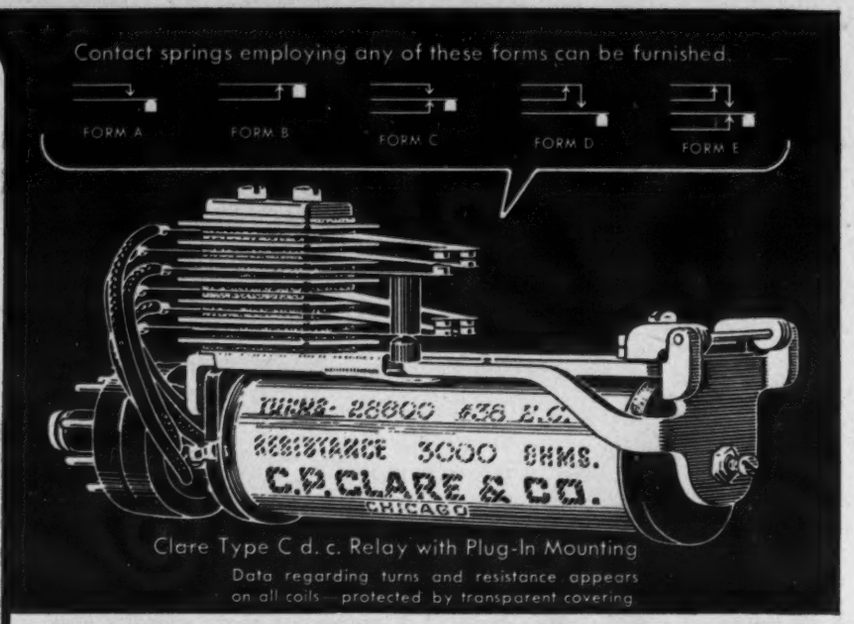
2. Pile-up assembly is locked together under hydraulic pressure. Projecting wafer insulators which provide creepage path of ¼" between contact springs can be furnished. The entire assembly withstands very heavy breakdown tests.

3. Heelpiece, coil core and armature assembly are of magnetic metal, carefully annealed. Where sensitivity and timing are important factors, a *special magnetic* metal is recommended to provide permeability.

4. Spring bushing insulators of Bakelite rod give excellent service where heavy contact pressures are employed, where vibration exists, or heavy duty service is desired.

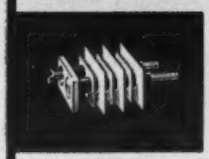
5. Coils are carefully wound to exact turns on precision machines. Lead out wires are securely soldered. Coils impregnated with special varnish are available. The coil is protected with a transparent acetate covering.

6. Relay illustrated is arranged for octal base plug mounting which makes for easy service and replacement. Other types of mounting, such as individual angle bracket, strip or panel can be furnished. Easy to handle slip-on Bakelite covers for individual mounting or metal covers for group mounting can be supplied.



Clare Type C d. c. Relay with Plug-In Mounting

Data regarding turns and resistance appears on all coils—protected by transparent covering



High voltage pile-up insulation withstands heavy break-down tests.

Contacts of rare metals and special alloys, welded to nickel silver springs.

Spring bushing insulators made by a patented process from Bakelite rod.

Double arm armature, stainless steel shaft in brass yoke can be furnished.

THE Clare Type "C" d.c. Relay is especially desirable for applications which require rapid opening and closing of circuits. It may be used for control of up to 12 circuits.

Special adjustment and special coil selection is necessary where operation of the relay involves limited coil current, extremely high speed operation, or other unusual requirements. In cases where unusually close operating limits are required, we recommend that complete data be submitted to Clare engineers.

Because of the wide range of contact arrangements possible with the Clare Type "C" Relay, Clare can "custom-build" you a relay that will most exactly fit your requirements. Standard spring assemblies may be equipped with any combination of the forms shown. Many different standard and special sizes of contacts may be provided.

Utilities find many uses for Clare Multiple Contact Relays for such purposes as initiation and control of equipment for automatic sub stations . . . for use in power stations, especially steam plants where boiler combustion control devices regulate proper relationship between fuel, feed, water and steam pressure . . . for modern pressure recording systems for indicator and alarm circuits . . . for sequence control and inter-locking operations.

While the Type "C" is designed to be mounted in a horizontal position, it will operate satisfactorily in any position. Spring assemblies may be located on either the right or left hand side for convenience in mounting.

Let Clare engineers know your specific relay problem. Send for the Clare data book and catalog. Write to C. P. Clare and Co., 4719 Sunnyside Avenue, Chicago (30), Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.

C L A R E R E L A Y S

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

RELIABLE Connectors

Save Time

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper

by using these connectors which are good as new after being salvaged.

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LOW IN COST

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Field Reports on Business

War production continues on a fairly even basis. Orders covering heavy electrical apparatus, motors, cable, control equipment for military purposes are heavy. Strong demand for highly specialized electrical apparatus, particularly in the line of field communications, exists.

NEW YORK

One of the most striking developments of recent months has been the gradual liquidation of inventories held by manufacturing firms, the Bureau of Foreign and Domestic Commerce reports. In the first four months of this year the value of manufacturers' inventories was reduced by more than $400-million with almost half of the reduction occurring during April alone.

War production continues on a fairly even basis, with output in some lines expanded and others cut back.

Civil engineering construction volume in continental United States totalled $34,477,000 last week. This volume was 23 percent higher than in the preceding week, but 43 percent under the total reported to Engineering News-Record for the corresponding 1943 week. Private construction topped the preceding week by 62 percent, and was 13 percent higher than in the corresponding week last year. Public work was 18 percent higher than a week ago as a result of the increased state and municipal volume, but was 48 percent under a year ago due to the drop in federal work. The week's construction brought 1944 volume to $891,830,000 for the 26 weeks, a decrease of 51 percent from the $1,826,400,000 reported for the period in 1943.

NEW ENGLAND

While New England industrial activity continues to decline mill and factory orders are well above pre-war production levels; retail trade is still at a high level; textile mill operations have slackened, but the demands for cloth goods for various war services is sustaining a relatively high output as compared with normal. In the electrical market, strong demand for highly specialized electrical apparatus, particularly in the line of field communications, signal and radio units, heating and ventilating units, and for lighting fixtures, offsets a moderate decline in industrial power sales. There is some prospect that new electric irons will enter trade this fall on a moderate scale.

Simplex Wire & Cable Co., Cambridge, Mass., has built a portable d.c. cable testing set which they are using for field service. Manufacturers of friction tape are bidding on large amounts of this material needed by the Navy. Electric cable, small switches, table model microphones, capacitors and fuse pullers are wanted in fair-sized lots. Contractors are more active in small wiring jobs and in the Boston downtown retail district repairs and renovations are being rushed for fall openings. The demand for fluorescent lighting units holds up steadily in small business establishments.

Inquiries in regard to infrared electrical applications have increased considerably of late. A 15-kw. installation has been made in a plant for baking paint on time recorders. Inquiries have been received for paint baking equipment to serve manufacturers of small vehicles. An early installation is contemplated for softening plastics to facilitate fabrication. Post-war highway projects estimated to cost $12,500,000 have been planned by Connecticut engineers. Highway construction in other New England states is getting under way with orders for highway lighting in the offing..

CHICAGO

War orders for heavy electrical apparatus, motors, cable, control equipment, switchgear, transformers and electronic apparatus continue to predominate, manufacturers in this area report. From a slow start during the first of the year some firms, particularly in the distribution field, report good order volume for the second quarter with indications pointing to still further improvements in the third and fourth quarters.

Expected further easing of restrictions on utility distribution extensions and approval of a number during June promise a volume of utility bookings for July that is expected to top levels of the last few months. Shortages in some essential component items, such as porcelain and to some extent steel are making it difficult for manufacturers to secure deliveries from suppliers. On other than strictly scarce items of materials, however, manufacturers material inventories are strong.

Producers of aluminum power transmission cable have been stranding conductors for six months. Manufacturers of copper conductors have been stranding aluminum for a somewhat longer period under WPB authority. At the present time it is reported that steel for ACSR conductor is more difficult to obtain than the aluminum. Present limitation on aluminum transmission cable production is available manpower rather than materials, it is stated.

Manufacturers of underground power cable report orders in good volume—but that it is almost entirely business. Utility orders are practically non-existent.

PACIFIC COAST

New major government construction is well distributed among various service branches, including $900,000 additional for Marine Corps air base at Santa Barbara; $600,000 for Army air training at Clovis, N. M.; $500,000 for Waves quarters at Oakland and $2,450,000 for Navy at Shoemaker, Calif. Other awards covering $2,500,000 for Naval auxiliary air station at Klamath Falls, Ore., and $742,000 for recreational facilities, etc. at Treasure Island carry a higher proportion of electrical lighting.

Equipment orders show seasonal increase in pumping motors and distribution transformers, and include a group of 530 motors, costing $35,000; carrier current equipment, costing $25,000 for a northern California line in Oroville area; synchronous motors for a Kaiser plant and a $30,000 assortment of transformers, battery chargers, etc. for a Navy base. Pacific Gas & Electric Co. has bought $35,000 of circuit breakers and its purchases of stock size transformers have considerably increased.

Industrial developments include a projected paint and varnish plant for Devoe & Reynolds in Oakland; a $700,000 addition to Pioneer Flintkote's paper processing mill; a tractor repair center approved by WPB for Los Angeles and a $900,000 addition to Texaco refinery as a pilot unit for hydrogenation of carbon monoxide.

Our Job is to be Ready for the Unknown

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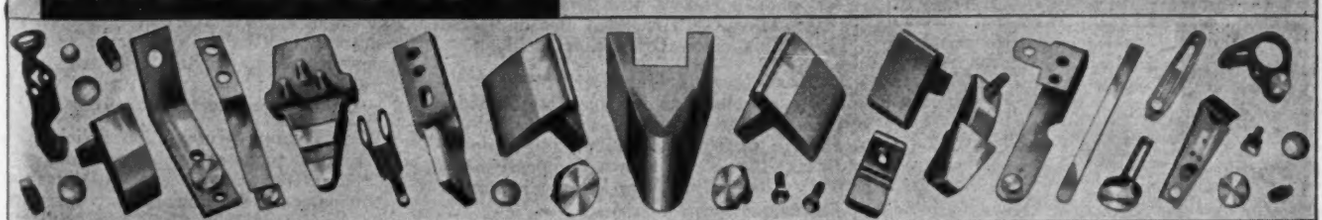

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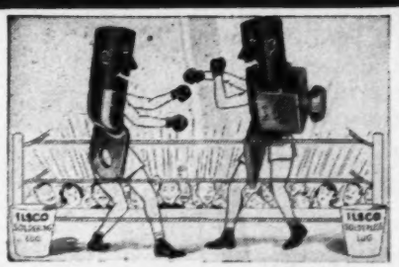

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Sales Opportunities

MARYLAND — Bethlehem-Fairfield Shipyard, Inc., Fairfield, has plans for new power substation at yard and will begin work at early date.

ILLINOIS—Buick Motor Division, General Motors Corp., Flint, Mich., will carry out expansion in aviation engine plants comprising new buildings, with machinery and electrical equipment for large increased capacity for government service. Cost estimated about $18,000,000, with financing by Defense Plant Corp. Work is scheduled to begin soon.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has authorized plans for expansion in central steam-generating station at naval drydocks, including installation of equipment for increased capacity. Bids are scheduled to be asked at early date. G. M. Richards & Associates, 333 Kearny St., San Francisco, are consulting engineers.

SOUTH DAKOTA—Bureau of Reclamation, Denver, Colo., has preliminary plans under way for four large irrigation, reclamation and power projects, to be carried out as post-war developments. Oahe project on Missouri River, designed to irrigate 200,000 acres, is estimated to cost about $25,000,000 and will require four years for completion; Angustura project on Cheyenne River, will irrigate 16,000 acres, cost about $5,160,000, and require two years for completion; Grand River project will provide for 28,500 acres, cost $3,886,000, and require 20 months for completion; and Moreau River project, designed for 27,150 acres, will cost about $4,639,000, and require 20 months. Each will include a series of pumping stations, with motor-driven pumping units of large capacity, controls and auxiliary equipment. Transmission lines will be built with power substations and service facilities.

NEW JERSEY—Wright Aeronautical Corp., 132 Beckwith Ave., Paterson, manufacturer of airplane engines, will carry out expansion in plant for production for government, including additional buildings with machinery and power equipment. Cost estimated about $2,500,000. Financing by Defense Plant Corp. Albert Kahn, Inc., New Center Bldg., Detroit, Mich., is architect and engineer. Work is being started.

LOUISIANA—Consolidated-Vultee Aircraft Corp., 7019 Franklin Ave., is arranging early call for bids for proposed expansion in plant, including new sub-assembling building, 50 x 400 ft., and several other structures. Machinery and electrical equipment will be installed for considerable increased capacity. Changes also will be made in present electrical equipment and facilities at plant. Entire project reported to cost about $800,000, with financing by Defense Plant Corp. Herbert A. Benson, Carondelet Bldg., New Orleans, is architect.

IOWA—Power & Light Department, Pella, has plans maturing for installation of new coal-handling system at municipal steam-electric generating station, and proposes to take bids soon. Brown Engineering Co., Valley Bank Bldg., Des Moines, is consulting engineer.

LOUISIANA—J. B. Beaird Corp., 2600 St. Vincent Ave., Shreveport, manufacturer of iron and steel products, plans addition to plant for forging and machining of steel shells for government. It will be one-story, cost estimated about $1,000,000, with machinery and electrical equipment. Financing by Defense Plant Corp. Bids are scheduled to be asked soon. Edward F. Neild, City Bank Bldg., Shreveport, is architect.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has authorized expansion in Naval Air Station, North Island, including additional buildings, boiler plant and barracks. Extensions will be made in electrical distribution system, service connections and other electrical facilities. Entire project will cost $1,700,000. Public Works Office, 11th Naval District, ft. of Broadway, San Diego, will be in charge.

INDIANA—Board of Trustees, Earlham College, Richmond, plans new power plant at institution as a post-war project, estimated to cost about $300,000, with equipment. Program will include two new institutional buildings and improvements in present structure, and is estimated to cost $1,243,000. Architect will be selected in near future.

COLORADO—Gates Rubber Co., 999 South Broadway, Denver, manufacturer of tires, tubes, mechanical rubber goods, etc., plans new four-story and basement addition, about 175 x 185 ft., reported to cost over $650,000, with machinery and electrical equipment. Proposed to ask bids soon on general erection contract. Project will have a priority rating. William N. Bowman Co., Insurance Bldg., Denver, is architect.

OHIO—Cleveland Electric Illuminating Co., Cleveland, has plans maturing for new one-story shop on East 17th St., near St. Clair Ave., to be equipped for welding work. Bids are scheduled to be asked at early date.

OHIO—Department of Public Properties, City Hall, Cleveland, Arthur L. Munson, director, is considering installation of floodlighting system at Kirtland Park for night baseball. Estimates of cost will be made.

OHIO—State Blind and Deaf School Commission, C. E. Woolman, secretary, 17 South High St., Columbus, has authorized surveys and plans for new school for deaf and blind, respectively, on 235-acre tract of land, formerly known as Wyandot golf course. Each will comprise several buildings; power plant will be built for central-heating service, with power substation, outdoor distribution lines, service connections and other electrical facilities. School for Deaf is estimated to cost $3,075,000; plans will be prepared by Frederick W. Garber, Union Central Bldg., Cincinnati, architect. and Sims, Cornelius & Associates, 2901 North High St., Columbus, associate architects. School for Blind will cost about $2,580,000; Maier, Outcalt, Dickerson & Associates, 13124 Shaker Sq., Cleveland, are architects, and Walker, Norwick & Templin, American Bldg., Dayton, associate architects. It is understood that project will be a post-war development.

WEST VIRGINIA—International Nickel Co., Huntington, plans expansion in plant, comprising several new one-story buildings, for extrusion, cold drawing and other service. Cost estimated about $1,200,000, with machinery and electrical equipment. Proposed to begin work soon. Project will have a priority rating. Main offices of company are at 67 Wall St., New York, N. Y.

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REA Allots New Funds for Rural Projects

Recent allotments announced by the Rural Electrification Administration, probably the last for the fiscal year ending June 30, total $9,344,600, bringing the total since REA was established to $499,007,801, of which $33,794,888 represents operations during the current fiscal year.

Alabama Electric Cooperative, Inc., Montgomery, Ala., has been allotted $2,805,600, which, together with funds from a previous loan, will permit the co-op to acquire and rehabilitate the generation, transmission and distribution system now owned by Alabama Water Service Co., to construct 619 miles of distribution line to serve 1,614 potential members, and to construct a generating plant with necessary new transmission lines to serve ten REA co-ops with wholesale power.

Federated Cooperative Power Assn., Hampton, Iowa, receives $125,000, which, together with funds remaining in existing allotments, will enable the co-op to increase the capacity of Allison substation and to construct a 500-kw. generating plant near Klemme, Iowa.

Four North Carolina co-ops receive a total of $2,450,000 as the initial loans toward costs of a proposed program which would involve purchase of rural properties now owned by private companies and construction of lines into now unelectrified rural communities within the co-ops' respective areas of service. Integration of these properties with existing and proposed rural lines of the cooperatives, according to REA officials, is essential to ultimate completion of a feasible program of rural electrification in the North Carolina areas. These allotments are: Pitt and Green Electric Membership Corp., Farmville, $300,000; Brunswick Electric Membership Corp., Shallotte, $800,000; Tri-County Electric Membership Corp., Goldsboro, $800,000; Pamlico-Beaufort Electric Membership Corp., Grantsboro, $550,000.

West Oregon Electric Cooperative, Inc., Vernonia, Oregon, receives $460,000 for an eventual total of 277 miles of line to serve 1,587 members. This includes $188,250 for the acquisition and rehabilitation of two generating plants and 77 miles of existing line.

The other 50 allotments provide, for the most part, for the extension of electric service to farms which can make a substantial contribution to the food production program. These allotments include:

ARKANSAS—Craighead Electric Cooperative Corp., Jonesboro, $112,000.

CALIFORNIA—Foothill Electric Assn., Inc., Fresno, $260,000.

ILLINOIS—Shelby Electric Corporation, Shelbyville, $50,000; M. J. M. Electric Cooperative, Inc., Carlinville, $50,000.

INDIANA—Fulton County REMC, Rochester, $30,000; Wayne County REMC, Richmond, $25,000.

IOWA—Allamakee-Clayton Electric Cooperative, Inc., Postville, $80,000; Monona County Rural Electric Cooperative, Onawa, $25,000; Rideta Electric Cooperative, Inc., Mount Ayr, $25,000.

KENTUCKY—Fleming-Mason Rural Electric Cooperative Corp., Flemingsburg, $50,000.

LOUISIANA—Jefferson Davis Electric Cooperative, Inc., Jennings, $60,000.

MINNESOTA—Douglas County Cooperative Light and Power Assn., Alexandria, $150,000; Wild Rice Electric Cooperative, Inc., Mahnomen, $150,000; Minnesota Valley Cooperative Light & Power Assn., Montevideo, $115,000; Lyon-Lincoln Electric Cooperative, Inc., Tyler, $50,000; Tri-County Electric Cooperative, Inc., Rushford, $100,000.

MISSISSIPPI—Tallahatchie Valley Electric Power Assn., Batesville, $50,000; Southwest Mississippi Electric Power Assn., Lorman, $50,000.

MISSOURI—Lewis County Rural Electric Cooperative Assn., Monticello, $100,000; West Central Electric Cooperative, Inc., Higginsville, $36,000; Ozark Border Electric Cooperative, Poplar Bluff, $25,000; Macon Electric Cooperative, Macon, $25,000; Central Missouri Electric Cooperative, Inc., Sedalia, $10,000; Co-Mo Electric Cooperative, Inc., Tipton, $10,000; Howell-Oregon Electric Cooperative, Inc., West Plains, $10,000.

NEBRASKA—Twin Valleys Electric Cooperative Assn., Cambridge, $565,000.

NEW YORK—Steuben Rural Electric Cooperative, Inc., Bath, $30,000.

NORTH CAROLINA—Woodstock Electric Membership Corp., Belhaven, $50,000.

OHIO—Washington Electric Cooperative, Inc., Marietta, $60,000; Adams Rural Electric Cooperative, Inc., West Union, $15,000.

PENNSYLVANIA—Central Rural Electric Cooperative Assn., Inc., Clearfield, $20,000; Valley Rural Electric Cooperative, Inc., Huntingdon, $53,000.

SOUTH CAROLINA—Broad River Electric Cooperative, Inc., Gaffney, $25,000; Laurens Electric Cooperative, Inc., Laurens, $20,000.

TENNESSEE—Middle Tennessee Electric Membership Corp., Murfreesboro, $150,000.

TEXAS—North Plains Electric Cooperative, Inc., Perryton, $158,000; Upshur Rural Electric Cooperative Corp., Gilmer, $50,000; Cherokee County Electric Cooperative Assn., Rusk, $50,000; Guadalupe Valley Electric Cooperative, Inc., Cost, $50,000; Rusk County Electric Cooperative, Inc., Henderson, $35,000; Bartlett Electric Cooperative, Inc., Bartlett, $30,000; Bowie-Cass Electric Cooperative, Inc., Douglasville, $25,000.

VIRGINIA—Southside Refrigeration Cooperative, Inc., Crewe, $53,000; Community Electric Cooperative, Suffolk, $16,000.

WASHINGTON—Inland Empire Rural Electrification, Inc., Spokane, $100,000.

WISCONSIN—Barron County Electric Cooperative, Barron, $75,000; Trempealeau Electric Cooperative, Inc., Arcadia, $65,000; Waushara County Electric Cooperative, Inc., Wautoma, $58,000; Grant Electric Cooperative, Lancaster, $50,000; Jump River Electric Cooperative, Inc., Ladysmith, $30,000.

HERE'S HOW BUSINESSMEN RATE NEW YORK STATE

You are planning now for the postwar period. Here are facts, revealed in a poll of New York State manufacturers, of real importance to you. Unbiased opinions, of men who know from years of practical experience, rate New York as a good State in which to do business.

91% give approval to New York for the availability of *raw and semi-processed materials*—both those produced in the State and those imported from all the world.

92% endorse New York's unexcelled and diversified *transportation system*—railway and truck transportation plus waterway and port facilities that give it a time and rate advantage in shipping to mass markets.

92% like the *cooperativeness* of New York State *labor*. In 1943 New York lost fewer manhours due to strikes than any other industrial State.

97% praise New York as a *market*. Over a quarter of the nation's population and a third of the retail sales right at hand put the nation's number one market at industry's doorstep in the Empire State.

92% approve the service and cost of the State's electric, water and gas *utilities*. New York is the nation's number one powerhouse, with continuity, flexibility and low cost of service.

91% give an O.K. to New York for the service and cost of *fuel*—coal, oil and gas.

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Recent Rate Action

NIAGARA FALLS POWER CO. will reduce its rates by approximately $1,000,000 a year in accordance with an order of the New York Public Service Commission. The reduction is in effect retroactive to Jan. 1, 1943, and involves a refund of about $1,500,000 to war plants in the Buffalo area, the commission announced. The proceeding which culminated in the reduction had its origin in 1941 when the company undertook to provide power for the rapidly expanding defense plants in the Niagara Frontier area.

KENTUCKY UTILITIES CO. has reduced its rates approximately $128,000 a year to a limited number of large power customers, whose rate is based on the cost of coal. The reduction, estimated to affect 250 companies, was made possible, the commission stated, through improved efficiency in generation of electricity and by increased interconnection of generating and transmitting facilities.

VIRGINIA PUBLIC SERVICE CO. charges for electric service were termed abnormally high in a unanimous opinion expressed by the Newport News City Council. A move to obtain lower rates in the community was started by the council in a motion to appeal to the State Corporation Commission for a special review of the local rate structure.

•

National Carbon Sets Up New Sales Organization

A new sales set-up under which all company products will be handled nationally from seven divisional offices is being installed by National Carbon Co., Inc. Four of the new offices are in operation and the others will be added by October 1.

All sales activities in the Southeast have been consolidated under a new Atlanta division office. J. F. Warnell, formerly manager under the "district" system and recently stationed at New York, has returned to Atlanta as division manager.

C. C. Joslyn is manager of the new Dallas (Tex.) division, and A. C. Bryan has taken over as division manager at Kansas City. On the West Coast, R. P. Tolles, manager of the former Pacific Coast division, assumes direction of the new San Francisco organization.

The three division offices yet to be opened will be located at Chicago, Pittsburgh and New York.

•

Formulates Safety Rules

As a contribution to the present drive for reduction of accidents in industrial plants, the Elwell-Parker Electric Co., Cleveland, Ohio, has formulated a set of safety rules for operators of power industrial trucks. These rules are intended to supplement the basic instruction of the operator.

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The 1944 edition of the McGraw Central Station Directory, ready for distribution about July 1st, lists in one compact volume every discoverable change in the electric utility industry during the past 12 months. Changes in personnel and operations up to May

1944 and other exclusive data on organization, areas served, generation and distribution equipment are included for each of 4,000-odd utility plants in the U. S., Canada and U. S. possessions.

Facts Presented:

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2. Names and addresses of affiliated, holding, controlling or managing and service companies with complete lists of properties controlled or managed by each, and including names and addresses of principal officials.

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- Superintendents of Transmission
- Plant Superintendents
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300 New REA Co-ops Listed:

904 REA co-operatives have been listed separately in the back of the Directory. This list includes 300 new co-operatives formed during the past year.

Use by Utilities:

The directory is used by hundreds of utility executives who wish to know about:

1. The organization of other utilities, especially those in own or adjoining areas.
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3. Discernible trends in expansions of operations of other utilities

Use by Manufacturers:

Manufacturers of electrical generating, transmission and distribution equipment, and manufacturers of general equipment and supplies, all serving the vast utility industry, make constant use of the directory for

1. Names and addresses of executive, supervising, managing and engineering officials.
2. Determining electrical characteristics of plant, equipment and lines now in use.
3. Knowledge of scope of operations: generating capacity, towns and number of meters served, etc.
4. For each operating company, the following information is presented:

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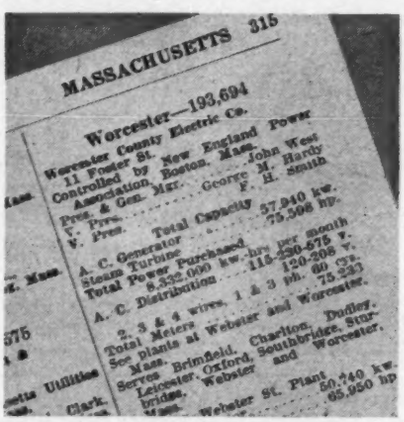
- Amount of power purchased in kw. hrs.
- Type of current distributed, No. of wires, phase, voltage and cycle
- Circuit miles underground—duct distribution
- No. of meters served
- Location of power plants
- Complete list of towns (of 500 population or over) served
- A complete alphabetical index of companies listed



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LETTERS TO THE EDITOR

Training Courses for Vocationalists

To the Editor of ELECTRICAL WORLD:

I congratulate ELECTRICAL WORLD on the very timely editorial entitled "Vocationalists" and others in the issue of May 13. It states well a problem that has not yet been fully appreciated by the various branches of the electrical industry. To date there is perhaps an insufficient number of electrical technical institutes to supply the demand that should exist for electrical technicians as contrasted to demand for the electrical engineering graduates who have received the conventional college training.

Many positions, formerly held by electrical engineering graduates, could be filled effectively by electrical technicians with two years of training. These men would be better satisfied for longer periods of time than are those who can use only a very small portion of their formal training. This issue may be forced in the decade ahead through an inadequate supply of electrical engineers, thus creating additional employment opportunities for men with technician training.

There is a growing feeling among young electrical engineering graduates in the armed forces that they will need "refresher courses" after the termination of the war before they can enter or re-enter industry. This is particularly true for those who have seen as much as three or four years of service by this time.

Requests for refresher courses as well as other terminal courses of varying lengths are reaching the educational institutions in increasing numbers. Accordingly, the Oklahoma Agricultural and Mechanical College is making exhaustive studies in anticipation of these needs. Prior to the present world war it had in successful operation various two year courses, including electrician training, in addition to the conventional four year courses in electrical and other branches of engineering. It is encouraged in these studies through expressions of opinion from industry regarding the needs for men and the training required for these men.

Your editorials are worthwhile contributions to these studies. It is hoped that the ywill stimulate reactions and expressions from various sources.

A. NAETER,
Electrical Engineering Department,
Oklahoma A & M College,
Stillwater, Okla.

Paralleling Rectifiers and Converters

To the Editor of ELECTRICAL WORLD:

I was very much interested in the article, "Rectifiers and Converters Paralleled on Zinc Cell Lines," by Mr. H. H. Zielinski, Industrial Engineering Division, General Electric Co., appearing in the May 18, 1944, issue of ELECTRICAL WORLD.

In 1938 I was associated with a project which involved the operation of ten 2,500-kw., 500-volt, 60-cycle rotary converters which were operated in parallel for several months with from two to eight 2,750-kw. multiple anode type mercury arc rectifiers.

Parallel operation was very successful, although no provisions were taken to insure automatic distribution of load between units nor were any special provisions made to protect the rectifiers against converter flash-over or the converters against rectifier arc-back.

Somewhat later on the same project, it was found convenient by reconnecting a rotary converter transformer from a delta primary to a wye primary to operate two rotary converters in series at approximately 640 volts, paralleling the two converters in series with ten 2,750-kw. mercury arc rectifiers.

The only special provisions made in this case was to provide about a 15-volt drop between the rotary converters and the rectifier bus. This system of operation was continued for about six or eight months.

Still later, it was found advantageous to parallel two of the 2,750-kw. rectifiers with approximately twelve converters. Once more, operation was quite successful, although in this case contact-making ammeters were employed to control rectifier grid bias voltage in order to limit the maximum rectifier current.

In all these cases, the rectifiers were of the multiple anode type. Later, in 1941, four Ignatron type rectifiers were so arranged that they could be paralleled with from four to a considerably larger number of rotary converters. Previous experience with the parallel operation of converters and rectifiers indicated that it was unnecessary to provide any special equipment to insure successful operation.

JAMES B. PITMAN,
Electrical Engineer,
Los Angeles Plant,
Aluminum Co. of America,
Torrance, Calif.

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ELECTRICAL ENGINEER, long utility experience in planning and design with operating and maintenance background, expert in sub and generating stations, overhead and underground lines and distribution available on short notice. PW-717, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

(Continued on page 160)

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Large manufacturer of roughing-in materials desires services of

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in cooperation with established agencies. Manufacturer does substantial national business. This man must have knowledge of these products and a broad acquaintance among wholesalers. In making application give complete summary of experience and educational qualifications, together with statement as to expected compensation.

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POSITIONS WANTED

(Continued from page 159)

ELECTRICAL ENGINEER—Professional state licensed, available June month for new connection in supervising capacity. Identified with the iron and steel industry for over 20 years. Have broad practical experience in selecting electrical equipment, designing installations, field supervisions and maintenance of modern industry development, including power stations. Past and present employments covers large steel corporations, manufacturers of rolling mill equipment and construction companies, etc. PW-692, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICIAN—20 years experience in steam generating stations as high tension switchboard operation and high tension repairman. Desires position where ability will be used to fullest extent. Public utility or railroad on west coast preferred. PW-711, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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75 HP Ditto at $450.00

112 HP 440 volt 3 phase 25 cycle 720 RPM type ITC GE slip ring motor in good used condition at $450.00

100 HP 2200 volt 60 cycle 680 RPM Allis-Chalmers squirrel cage good used condition at $375.00

1—225 HP 440 volt 25 cycle 500 RPM GE type ITC8071 slip ring motor good stator but rotor need repairs at $200.00

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HP	Make	Type	Volts	Speed
1250	G.E.	MPC	550	130
1200	Whse.	Compen.	550	600/720
800	G.E.	MPC	660	600
625	G.E.	MPC	500	130
600	G.E.	MPC	600	650/900
500	G.E.	MPC	230	900
500	Whse.	Compen.	250	240/720
300	G.E.	DMC	230	400/600
300	G.E.	MPC	230	275/550
270	Whse.		550	250/400
250	G.E.	C	230	375
250	Al. Ch.		230	525
200	Whse.		230	400
175	Whse.	SK	250	150/545
150	G.E.	RC-19A	230	800/1000
150	G.E.	MPC	230	250/450
130	Cr. Wh.	CMC-65H	550	1200
125	G.E.	CO-1832	230	625
100	G.E.	LC-50	230	1200
100	G.E.	MPC	230	225/450
100	G.E.	RC-19	230	575/720
75	G.E.	LC	230	500/1000
75	Whse.	SK-183	230	560/1100
60	El. Dv.	25S	230	525/1050
50/60	Cr. Wh.	65H	230	500/1000
50	Cr. Wh.	CMC-81H	230	300/900
50	G.E.	RF-16	230	400/1200

TRANSFORMERS

KVA	Make	PH	Type	Voltage
1667	Pitts	1	OISC	13200x2300
1050	G.E.	3	WCTH	11000x445
600	G.E.	3	HT-OISC	11550x2200
333	Moloney	1	C-OISC	22000/11000x2300/575
333	Whse.	1	OISC	2300x460
333	Pitts.	1	OISC	2400x220
300	G.E.	1	H-RP	13200x575/1150/2300
300	Pitts.	3	ODSC	4150x208/120
300	Packard	1	OISC	2200x220/440
200	G.E.	1	H-LDD	26400x115/460
200	G.E.	1	H-OISC	2300x115/230

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP, 2300 V. Syn. Motor
1—1500 KW Whse 250 v DC to 2100 HP 4400/2200 v.
1—1000 KW Whse. 600 V. Gen. d.c. to 1400 HP 4000 V. Syn.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW G. E. 250/375 V. Gen. to 700 HP ATI 440/2300/4000 V. Motor
1—350 KW G. E. 220 v AC Gen. d.c. to 500 HP 350 v DC motor.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V. Ind. Motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	D.C Volt	Trans. Volts
1— 1500	Whse.	720	600	2300
1— 1500	Whse.	600	600	11500
1— 1250	G.E.	720	250	2300
1— 1000	G.E.	900	600	132000
1— 1000	Whse.	600	250	22000
1— 1000	Whse.	900	600	11000
1— 750	G.E.	1200	600	2300
1— 750	Whse.	720	250	6600/2300
1— 500	Whse.	1200	600	13200/2300
1— 375	G.E.	1200	250	6600/2300
2— 300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	600	Al. Ch.		2200	720
1—	500	G.E.	TS	440	360
1—	225	G.E.	ATI	240	600
1—	125	G.E.	ATI	220/440	900
1—	100	Whse.	G	2200	1800
1—	109	G.E.	ATI	220/440	720
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr.-Wh.	801-Q	2200	237
2—	1000	Whse.	CW	2300	720
1—	800	Whse.	CW	440	357
1—	800	Al. Ch.		440	885
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	875
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	350	G.E.	IM	2300/4000	257
1—	300	Whse.	CW	440	585
1—	300	G.E.	IM	440	720
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600
1—	150	Whse.	CW-772C	2200	1160
1—	150	G.E.	IM-17	2200	435

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150
1—	125	G.E.	IK	220	720

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	750	G.E.	ATI	220/440	900
1—	600	G.E.	ATI	220 440	900

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N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E. sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E. vertical

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 950 RPM, General Electric
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, G.E., 2200-220/440 volt.
3—200 KVA, Allis-Chalmers, 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 6 KW, 125 volt, General Electric, squirrel cage.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electric Dynamic.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

2—1500 KW MOTOR GENERATOR SETS

2—1500 KW Westinghouse, 250 volts, commutating interfield poles, direct-connected on sub-base to
2—2250 KVA Westinghouse synchronous motors, 3 phase, 60 cycle, 12000/2300 volts, 360 RPM.

Can furnish rebuilt, or good condition as taken from service.

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New "SEARCHLIGHT" Advertisements

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ELECTRICAL WORLD
330 West 42nd St., New York City

Alphabetical Index to Advertisers

Acme Electric & Mfg. Co., The.... 148
Air Preheater Corp., The..... 16
*Allis-Chalmers Mfg. Co.....8, 10, 11
Aluminum Co. of America..... 25
*American Brass Co., The..... 50
American Coach & Body Co..... 115
American Cyanamid Co. 36
American Fork & Hoe Co..... 115
*American Steel & Wire Co..... 17
American Tel. & Tel. Co..... 58
*American Transformer Co..... 125
*Anaconda Wire & Cable Co..... 117
Automatic Sprinkler Corp. of America 126

Babcock & Wilcox Co., The....60, 61
Bakelite Corporation 64
*Bentley, Harris Mfg. Co..... 12
Bethlehem Steel Co. 56
*Biddle Co., James G..... 114
Blaw-Knox Co. 69
*Bull Dog Electric Products Co.... 45
*Burndy Engineering Co. 55

Celanese Celluloid Corp. 68
Chapman & Co., Inc., A. D..... 132
*Clare & Co., C. P. 149
*Continental-Diamond Fibre Co... 154
*Cornell-Dubilier Electric Corp.... 35
Corning Glass Works 33
Crescent Tool Co..... 22

Dampney Company of America, The 137
De Laval Separator Co., The..... 52
Delta Star Electric Co..... 53
Directory of Engineers..... 158
Doolittle Radio, Inc..... 138
*Dow Chemical Co., The..... 133
Driver-Harris Co. 63
Dugas Engineering Corp..... 118

Electric Controller & Mfg. Co.... 37
Electric Service Manufacturing Co. 9
Electric Storage Battery Co., The 54
Elliott Co. 6
Engineers, Directory of 158
Everstick Anchor Co. 152

Federal Electric Products Co..... 29
Federal Tel. & Radio Corp..... 57
*Four Wheel Drive Auto Co..... 121
Frigidaire Division of Gen. Motors 119
Frink Corp., The 66

G & W Electric Specialty Co..... 32
*General Electric Co. 103, 105, 107, 109, 153
Goodrich Co., B. F., Industrial Pds. Div. 39
*Graybar Electric Co. 5

*Hazard Insulated Wire Works.... 4
Hendy Iron Works, Joshua..... 59
Hi-Voltage Equipment Co..... 130
Holzer-Cabot Electric Co..... 131
Hubbard & Co. 129

*Illinois Electric Porcelain Co..... 40
*Ilsco Copper Tube & Products Co. 152
Indiana Steel & Wire Co..... 140
*I-T-E Circuit Breaker Co..Third Cover

Jenkins Bros., Rubber Div..... 138

Kelvinator, Div. of Nash-Kelvinator Corp. 122, 123
Kidde & Co., Inc., Walter..... 24
*Klein & Sons, Mathias..... 136
*Kuhlman Electric Co.....Back Cover

*Lapp Insulator Co., Inc..... 65
*Leeds & Northrup Co..... 28
Line Material Co..... 113

Mallory & Co., Inc., P. R..... 151
Matthews Corp., W. N..... 13
McGraw-Hill Book Co., Inc..... 156
*Metropolitan Device Corp. Second Cover
Miller Company, The..... 62
*Moloney Electric Co..... 67
Mosinee Paper Mills Co..... 134
Mossman, Inc., Donald P..... 44

National Electric Products Corp.. 70
National Telephone Supply Co.... 42
New York State Department of Commerce 155
North American Philips Co., Inc.. 48

Ohio Brass Co. 15
*Okonite Co. 4
*Okonite-Callender Cable Co..... 4
Overton Co., S. E..... 148
*Owens-Corning Fiberglas Corp.... 147

*Pacific Electric Mfg. Corp..... 26
Page Fence Association..... 148
Panelyte Division, St. Regis Paper Co. 51
Paragon Electric Co..... 140
*Penn-Union Electric Corp..... 124
*Porcelain Insulator Corp., The.... 142
Premax Products, Division Chisholm-Ryder Co., Inc..... 148
Public Utilities Adv. Assn..... 156

*Radio Corp. of America.....41, 47
*Railway & Industrial Engineering Co. 7
*Reliable Electric Co..... 150
Revere Copper and Brass, Inc.... 111
Richardson Company, The..... 34
*Rockbestos Products Corp..... 141
Rockwood Sprinkler Co..... 38
*Rusgreen Mfg. Co..... 154

*Sangamo Electric Co..... 27
Schramm, Inc. 43
Schweitzer & Conrad, Inc..... 23
Searchlight Section.....159, 160, 161
Shell Oil Co. 49
*Sherman Mfg. Co., H. B..... 132
Simplex Wire & Cable Co..... 30
*Spang-Chalfant, Div. of The National Supply Co. 18
*Stackpole Carbon Co..... 139
*Star Porcelain Co..... 156
*Struthers-Dunn, Inc. 143

Texas Company, The..... 31
Thornton Tandem Co..... 145

Union Carbide and Carbon Corp.. 64
*United States Steel Corp..... 17

SAVE TIME

To save time and money—your time and your money—that's the purpose of the many products and services advertised in this issue of Electrical World. Check through the advertising pages for information that can be of direct benefit to you.

*Westinghouse Elec. & Mfg. Co. 21, 46, 127
*Wolfe & Mann Mfg. Co., The..... 14
Wrigley, Jr., Company, Wm..... 116

■

PROFESSIONAL SERVICES 153

■

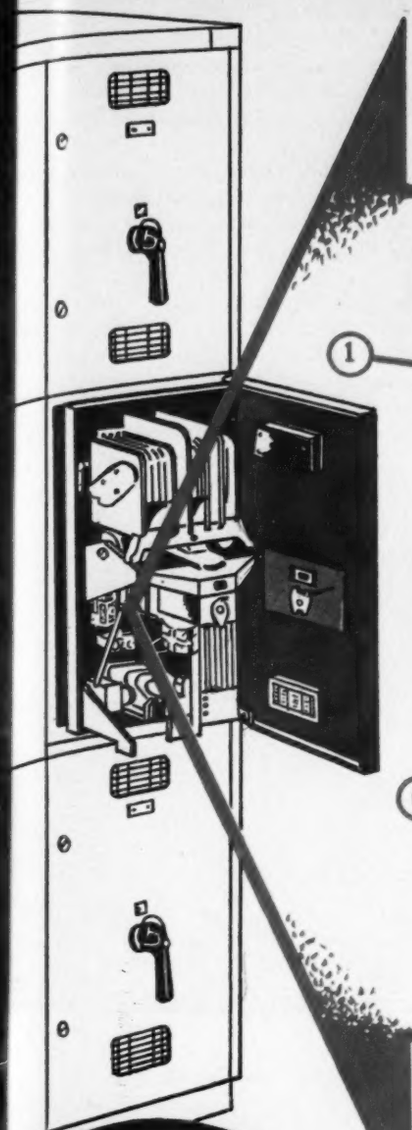
SEARCHLIGHT SECTION

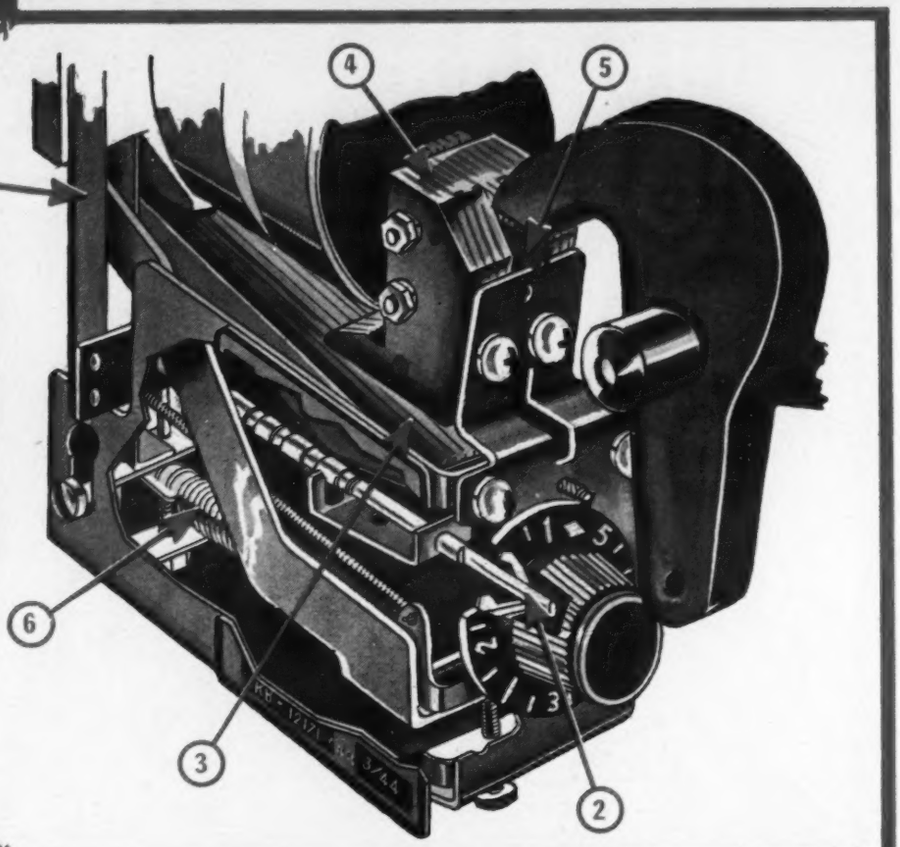
(Classified Advertising)

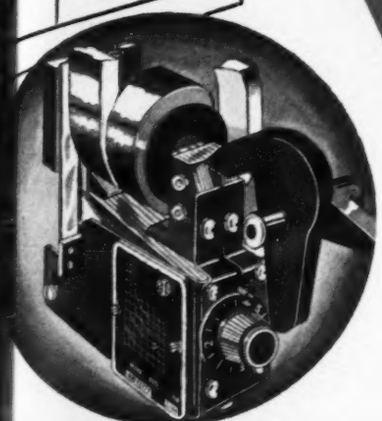
BUSINESS OPPORTUNITIES 160
EMPLOYMENT SERVICE 159
POSITIONS VACANT 159
POSITIONS WANTED 159-160
SELLING OPPORTUNITIES 160
WANTED TO PURCHASE 160
USED EQUIPMENT 160-161
Belyea Co., Inc.....161
Brew, Woltman & Co.....160
Chicago Electric Co.....161
Dulien Steel Products, Inc.....160
Ebasco Services, Inc.....161
Electric Service Co., The.....160
Hemphill & Co., J. L.....161
Morse Bros. Machy. Co.....160
Solon, M. C.....160

★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

A-C Motors get full protection with this Dual Thermomagnetic Overcurrent Trip







...nted on the side of each Thermomag-...c Overcurrent Trip is a plate showing ...cal time-load curves corresponding to ...tified dial settings. The dial is notched ...ermit intermediate settings, numbering ...en in all. A spring lock prevents acci-...al turning of the knob.

(1) **BIMETAL ELEMENT,** heated inductively, causes circuit breaker to open on normal overloads only after a selected time delay. Full voltage starting is permitted with heavy inertia loads yet protection is given against light, continuous overloads such as single phasing. Heating of the element is so arranged as to avoid burnout or permanent distortion. No current flows through the bimetal.

(2) This **SHAFT** is moved forward by the heated bimetal element in starting the action of tripping the circuit breaker. The tripping effect of the forward motion is adjustable at the knob into which the shaft fits. This is like changing the bimetal heating characteristics in relation to the characteristics of the protected motor or in relation to ambient temperature.

(3) This **ARMATURE** moves, in tripping action, either in response to a preselected temperature in the bimetal or to the existence of an overload in the motor circuit equal to twelve times the rated current of the circuit breaker. This gives instantaneous opening on short circuits yet provides time delay for starting peaks and light overloads.

(4) An **ELECTROMAGNET,** energized by a surrounding series coil, has three functions: to attract the armature for direct tripping of the circuit breaker in response to extremely heavy overloads and short circuits; to serve in inductively heating the bimetal element on light overloads and by saturation to control the effect of overcurrents on the heated parts in order to prevent burnout or damage to the bimetal element.

(5) **A TRIPPING PIN** is driven against the latch of the circuit breaker when the armature is attracted to the magnet. Circuit conditions which affect the magnet are directly translated into circuit-opening action when opening is necessary.

(6) This **SPRING,** which carries no current, is preloaded to supply the correct restraint on the armature so that overcurrent of less than 12 times the rated current of the circuit breaker will cause opening only after an exactly appropriate time delay.

In combining the best characteristics of thermal overload devices and magnetic tripping, the I-T-E Thermomagnetic Trip provides protection for individual A-C motors against the effects of both light and heavy overloads. The breaker is tripped before dangerous motor temperatures are reached, but the breaker is not opened needlessly. The time-current characteristics of the device can be adjusted in exact keeping with the heating characteristics of the motor. Motors so protected can be used at full rating. For complete information, call your nearest I-T-E representative or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

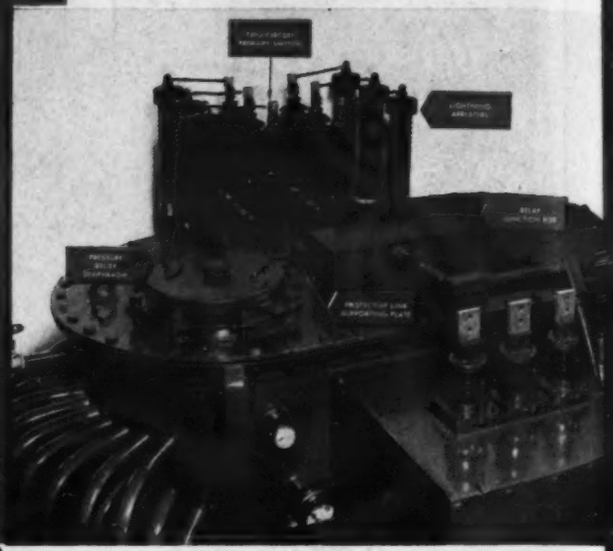
Representatives in Principal Cities

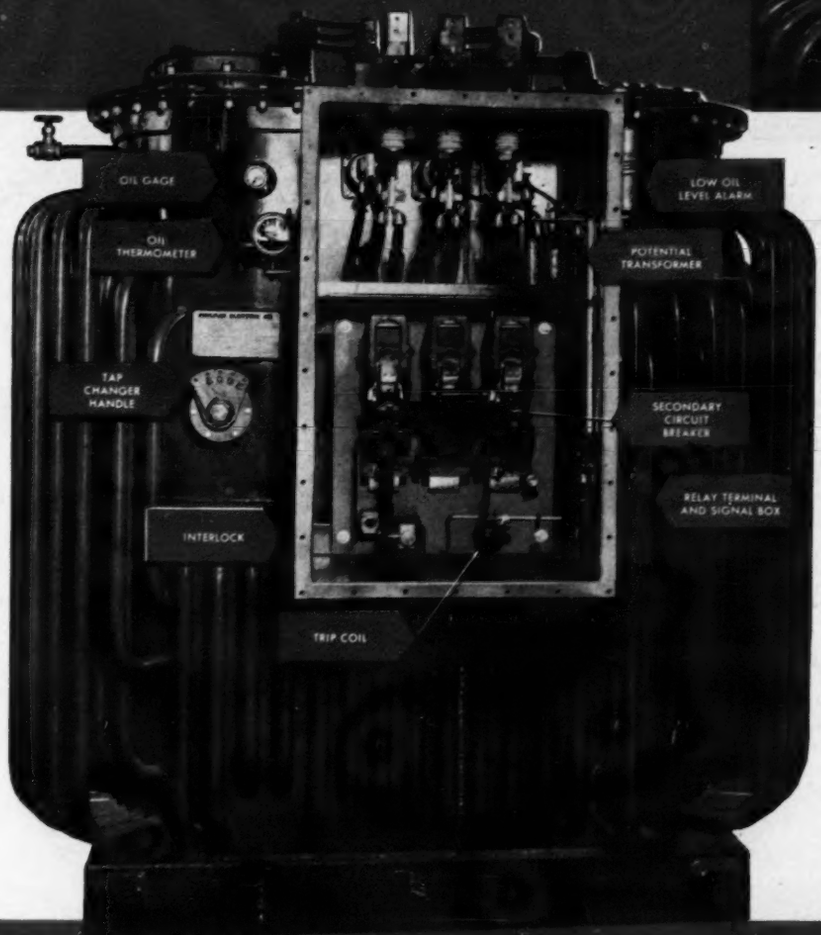
I-T-E AIR SWITCHGEAR

KUHLMAN
1000 KVA
C·S·P·
TRANSFORMER

Described here is the application of t e C.S. principle to Power Transformers. Tot lly se contained, this transformer can be insta led an connected directly to primary and se ondar circuits without bus structures or exter al aux liaries of any kind. The features that m ake th possible are:

1. Three-position oil immersed primar switch permitting switching under excitation to or fro either of two three-phase lines.
2. Lightning arresters protecting both rimar lines.
3. Rugged, internal primary fusible links o high interrupting capacity for isolating tran former from power lines in case of inter al fai ure.
4. Ample, sealed air space above oil wit weather proof pressure relief device.





5. Low oil level alarm and tripping switch.
6. Three-pole secondary air circuit breaker manually closed, electrically or manually tripped.
7. Current transformer with thermal relay mounted in hottest oil in each phase. Relays light signal lamps when copper temperature in each phase reaches maximum operating level and trip the breaker when safe emergency over-load temperature limits are reached.
8. Accessible switch for electrically resetting relays after signal or tripping operation.
9. Key-controlled interlock prevents operation of primary switch without first opening secondary breakers.
10. Potential transformer for auxiliary circuits.
11. Usual accessories such as no-load tap changer, oil thermometer, oil level indicator, filter press connections, drain valves, jack lugs, etc.

Kuhlman